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PHOENIX TIMBER SALE

DRAFT ENVIRONMENTAL IMPACT STATEMENT



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Montana Department of Natural Resources and Conservation
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ABBREVIATIONS

Ac	Acres
Alt	Alternative
Bdft	Board Feet
BLM	Bureau of Land Management
BMP	Best Management Practices
CFR	Code of Federal Regulations
DBH	Diameter at Breast Height
DEIS	Draft Environmental Impact Statement
Dept	Department
DEQ	Department of Environmental Quality
DF	Douglas fir
DFWP	Department of Fish, Wildlife, and Parks
DNRC	Department of Natural Resources and Conservation
ECA	Equivalent Clear-cut Acres
EIS	Environmental Impact Statement
EMU	Elk Management Unit
EPA	Environmental Protection Agency
ERZ	Equipment Restriction Zone
FEIS	Final Environmental Impact Statement
FI	Forest Improvement
FY	Fiscal Year
IWM	Integrated Weed Management
LP	Lodgepole Pine
LNF	Lolo National Forest
LWD	Large Woody Debris
MBF	Thousand Board Feet
MCA	Montana Code Annotated
MEPA	Montana Environmental Policy Act
MMBF	Million Board Feet
N/A	Not Applicable
R-1	Region 1 of the U.S. Forest Service
R-4	Region 4 of the U.S. Forest Service
RHCA	Riparian Habitat Conservation Areas
ROD	Record of Decision
RMS	Resource Management Standard
SFLMP	State Forest Land Management Plan
SMZ	Streamside Management Zone
SSFI	Sale Specific Forest Improvement
Trib	Tributary
TMDL	Total Maximum Daily Load
US	United States

USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WS	Watershed
WQLS	Water Quality Limiting Segments
WYI	Water Yield Increase

CHAPTER 1 – PURPOSE OF THE PROJECT

PROPOSED ACTION AND OBJECTIVES

Introduction and Description of the Proposed Action

The Department of Natural Resources and Conservation (DNRC), Anaconda Unit, proposes to harvest timber on State lands to generate revenue for the Montana Public School Trusts. The project area is located approximately 12 miles northwest of Philipsburg, Montana, and involves portions of Sections 5, 8, 17, 21, and 28, Township 8 North, Range 15 West, for a total gross sale area of approximately 1786 acres (see vicinity map, Figure I-1). If a harvest alternative is selected the sawlog volume would range between 1.5 and 3 MMBF of sawlog material. This material would be harvested from approximately 300 acres with various silvicultural treatments. To enable harvesting operations, between 4.38 and 5.06 miles of new road construction would be required. Road reconstruction would involve 2.18 miles, while .1 to .3 miles of temporary road would be constructed. In addition to harvesting sawlogs DNRC proposes to commercially thin up to 1200 acres of 60-80 year old lodgepole pine by harvesting posts and rails. Sawlog harvesting could begin as early as 2004 with all associated activities being complete by the year 2009. Harvesting of the post and rail material could begin in 2004 and would be completed by 2011.

Project Need

Lands involved in this proposed project are held by the State of Montana in trust for the support of specific beneficiary institutions. These include public schools, state colleges and universities, and other specific state institutions, such as the School for the Deaf and Blind (Enabling Act of February 22, 1889; 1972 Montana Constitution, Article X, Section 11). The Board of Land Commissioners and the Department of Natural Resources and Conservation are required by law to administer these trust lands to produce the largest measure of reasonable and legitimate return over the long run for these beneficiary institutions (Section 77-1-202, MCA).

Project Objectives

The Department has developed the following specific project objectives:

1. Produce the largest measure of reasonable and legitimate return to the trust accounts.
2. Provide 1.5 to 3.0 MMBF of the Southwestern Land Office (SWLO), DNRC, volume contribution to the annual timber harvest on State trust lands that is required by State law (77-5-221 through 223, MCA).
3. Manage for conditions characterized by the proportion and distribution of forest types and structures historically present on the landscape.

Relationship to the Administrative Rules for Forest Management (ARM 36.11.401 through 36.11.450) DNRC adopted Administrative Rules for Forest Management activities including the management of old growth stands in March of 2003. The new rules do not apply to this project, since this project was scoped prior to the adoption of the Rules (ARM 36.11.402(2)). However, since this project proposes an alternative that harvests old growth, the department is required to review it to ensure compliance with the new Rules for biodiversity and old growth.

THE ENVIRONMENTAL IMPACT STATEMENT (EIS) PROCESS

EIS Development

This EIS was prepared in compliance with the Montana Environmental Policy Act (MEPA). MEPA requires State government to include consideration of environmental impacts in its decision making process. It also requires agencies to inform the public and other interested parties of the proposed projects, environmental impacts that might result, and alternative actions that could achieve project objectives.

Public Scoping

The initial stage of an EIS is the public scoping process, which is used to inform the public that a State agency is proposing an action and to gather comments on the possible impacts of the project. The scope of this EIS was determined by the professional judgment of resource specialists in DNRC, other State agencies, and comments from the public and other interested parties.

Public participation was originally solicited in September 1998 by distributing a letter and the initial project proposal to individuals, adjacent landowners, organizations, industries, and agencies. Notices were also placed in the Montana Standard and Philipsburg Mail newspapers. The mailing list of parties receiving initial scoping notices for this project is located in the project file at the Anaconda Unit Office. Public scoping comments were summarized and can be found below. The original comments are also located in the project file at the Anaconda Unit Office.

Draft EIS (DEIS)

Following scoping, a DEIS is prepared incorporating public comments relating to the issues that could affect the project. Immediately upon publication, the DEIS is circulated to everyone known to be interested. Comments are accepted for 30 days.

Final EIS (FEIS)

DNRC will prepare a FEIS or adopt the DEIS as the FEIS after all public comments to the DEIS are received and evaluated. The FEIS will incorporate new information based on public and internal comments.

Notification of Decision

Following publication of the FEIS, the decision maker will review the information contained in the DEIS and project file including public comments. No sooner than 15 days after the publication of the FEIS, the decision maker will determine the following:

- Do the alternatives presented in the FEIS meet the purpose of the project?
- Was there an adequate range of alternatives evaluated?
- Are the proposed mitigations adequate and feasible?
- Which alternative or combination/modification of alternatives should be implemented and why?

These determinations will be published in a Decision Notice or a Record of Decision, which will be distributed to all interested parties.

Proposed Schedule of Activities

After the Record of Decision is published, and if an action alternative is selected, a Timber Sale Contract package would be prepared. The package would be sent to the State Board of Land Commissioners for approval. If the Land Board approves the project, the timber sale would be advertised. If the timber is sold, the following schedule would apply:

The Anaconda Unit would propose to sell timber from the Phoenix project in fiscal year 2004. All harvesting, road construction and improvement work could begin in the summer or fall of 2004 and be completed by March 1, 2011. Hazard reduction work would be completed within 2 years following the completion of harvesting. Some activities would be restricted to certain periods of the year to avoid or reduce impacts (see Chapter 4 for mitigation information).

Overview of the Project

The proposed Phoenix Timber Sale is located in the Upper Willow Creek drainage northwest of Philipsburg, Montana ranging from 5440 to 5920 feet in elevation. Timber harvesting, road building, and other associated management activities are proposed on five forested school trust sections. The proposed activity would occur within the Beaver, Bear, Huepeck, Arbuckle and Slusser Creek watersheds. The sale if implemented could start as soon as 2004 and continue until 2011. Even-aged and uneven-aged harvest prescriptions would be used to meet the project goals and would be implemented on 300 acres of the 1786 acres in the gross sale area.

To accomplish this project and provide better access for future management of these parcels, approximately 5.06 miles of new road would be constructed and approximately 2.18 miles of existing road would be improved to meet Montana's Best Management Practices (BMPs). In addition up to .3 miles of temporary road would also be required.

The project area consists of gently to moderately sloping hills with stands dominated by

lodgepole pine and occasional Douglas fir. The lodgepole stands in Section 5 of the project area have resulted from stand-replacing fires followed by several lower intensity underburns. The trees are over 140 years old with many having fire scars from frequent low intensity burns, which took place prior to fire suppression activities. Fire acts as a cleaning agent for the forest by removing fuel build-up. Since fires have been suppressed in this area for the last 80 years, fuel build up in this stand has been substantial. This is also prevalent in other older stands within the proposed sale area. Lodgepole stands in Sections 8 and 17 also resulted from a stand-replacing event, but the trees are younger, between 60 and 80 years old. Stands in Sections 21 and 28 resulted from mixtures of hot and cool fires. The sites are warmer and drier than those in Sections 5, 8 and 17. Development of these stands appears to have resulted by encroachment onto what were probably grassland sites. These stands have remnant large-sized Douglas fir and ponderosa pine trees, as well as lodgepole pine. Proposed harvests would emulate natural disturbances including: 1) hot, stand-replacing fires, 2) mixed severity and, 3) cool low intensity burns. To emulate a hot fire, most of the stand would be removed. To mimic mixed severity burns large-sized Douglas fir and ponderosa pine would be retained and understory trees, normally lodgepole pine would be removed. To simulate a cool under burn, second growth lodgepole pine would be thinned using post and rail harvests. Several large units (up to 495 acres) would have a post and rail thinning harvest. These areas currently have approximately 1,000 stems per acre, composed of mostly 2 to 6 inch lodgepole pine trees. In these areas trees showing the best timber characteristics would be retained at 8 to 12 foot spacing.

Throughout this document the type of harvesting being proposed will be discussed. Management of these forested tracts is based on emulating natural processes and events, usually fire, which occur in a forest. This type of management does not fit very well with the classic European Forestry that has been historically practiced in this area. These are cutting methods in classic European silvicultural terminology, which can be crudely analogous to the proposed harvest:

- a) Hot stand replacing fires (SR)→analogous to clearcutting.
- b) Mixed severity fires (MS)→analogous to seed tree or one-step shelterwood.
- c) Cool low intensity fires (LI)→commercial thinning.

For the remainder of this document abbreviations and descriptions for the natural events we are proposing to emulate will be used instead of the classic European terminology.

Access to these parcels is via U.S. Forest Service, Road #4325, a BLM Low Standard Road, and privately owned roads controlled by local landowners. These School Trust lands are surrounded by a combination of private, BLM and U.S.F.S. land. Timber proposed for harvesting is a mixture of second growth, (60-80 year old), and mature timber (100-140+ years old).

DNRC intends to manage these parcels for healthy and biologically diverse forests. This would be achieved by managing toward more natural and historic stand structures and by reintroducing fire, where feasible, which is a natural process that these forest types have evolved with and has been basically absent for the past 80 years. The proposed harvests are designed, in part, to reflect historical roles that fire played in this cover type. Lodgepole pine seedlings require full sunlight and bare mineral soil to regenerate. These conditions usually resulted from hot, stand replacing, fires which killed all the trees over many acres at one time creating new stands of relatively the same age. This gives lodgepole pine stands a uniform appearance. The proposed management

regime for these parcels is to develop age class structures that would maximize long-term return to the school trust. DNRC would plan to enter these parcels approximately every 20 years to harvest forest products. Intermediate entries such as thinning, salvages, and maintenance projects would also be needed to fulfill these goals.

TABLE 1-1
Acreage Clarification

Item	Legal	Acreage
DNRC Land within the drainage	Sec. 5,8,16,17,21,28, T8N, R15W Sec. 16 T7N, R15W	2,826
DNRC timberland within the drainage	Sec. 5,8,16,17,21,28, T8N, R15W	2,186
DNRC timberland which is involved in the proposed action alternatives	Sec. 5,8,17,21,28, T8N, R15W	1,786

R14W



COOPERATING AGENCIES WITH JURISDICTION AND REQUIRED PERMITS

- A Stream Preservation Act Permit (124 Permit) is required from the Department of Fish, Wildlife, and Parks (DFWP) for activities that could disturb the bed or banks of any perennial stream.
- DNRC is a member of the Montana Airshed Group, which regulates slash burning that is done by DNRC. DNRC received an air-quality permit through participation in the Montana Airshed group.

CONCERNS RAISED DURING SCOPING

Through the scoping process, issues were raised by the public, specialists from the DNRC, special interest groups, and other agencies about the potential impacts of the proposed action to the environment. The issues are grouped and summarized below. Some of the issues will not receive further analysis in the EIS. The rationale for not carrying those issues forth is explained. The remaining issues will be analyzed further in the EIS.

Comments were received expressing concerns that:

Hydrology

- **The proposed action may adversely affect water quality and have negative cumulative impacts throughout the drainage**

Concerns related to water centered on three items:

Water Quality: Land management activities such as timber harvesting and road construction can impact water quality by accelerating sediment delivery to streams above natural levels. These impacts are caused by sediment produced from roads, skid trails in harvest units, removal of vegetation along stream channels, and by the installation of structures for crossing stream channels.

Cumulative Watershed Effects: Potential cumulative watershed effects include impacts to water quality and quantity that result from the interaction of past and current activities and the proposed action. Timber harvesting and other activities can affect the timing of runoff, increase peak flows, and increase overall water yield of drainage. Increased peak flows and/or duration of peak flows may result in physical damage to stream channels causing instability, loss of fish habitat and downstream water quality impact.

Cold Water Fisheries: Land management activities such as timber harvest and road construction can impact cold water fisheries habitat by accelerating sediment delivery to streams, reducing potential recruitment of large woody debris, and reducing fish passage. These impacts are caused by sediment produced from roads, skid trails and landings.

removal of vegetation along streams, and by the installation of stream crossing structures. A concern was also raised that the watershed restoration activities planned under the proposed action could result in the movement of brook trout into a stream reach containing a known population of bull trout.

These concerns will be further analyzed in Chapters 3 and 4.

BMP Installation

- **Concern was expressed that Best Management Practices (BMPs), which would be implemented under action alternatives, would not be effective.**

If an action alternative were to be selected, a DNRC hydrologist would locate site-specific mitigations designed to maintain or improve water quality within the project area. These specific measures would be included in the timber sale contract and would be enforced by the timber sale administrator.

In 1989, the Montana Legislature directed the Montana Department of State Lands (DSL) to evaluate forest practices for Best Management Practice (BMP) implementation and report the findings to the Environmental Quality Council. An interdisciplinary field audit process was developed which evaluated forest practices on all major land ownership groups including State, Federal, industrial private and non-industrial private. That process is still used today to evaluate whether BMPs are being applied and whether they are effective in limiting non-point source pollution on timber harvest and associated activities. These audits are conducted by interdisciplinary teams composed of a forester, hydrologist, soil scientist, fisheries biologist, road engineer, logger and conservationist. These people are recruited from the forest products industry, conservation community, state and federal land management agencies, regulatory agencies, and private forest landowners. Since that time DSL has been reorganized into the Montana Department of Natural Resources and Conservation (DNRC). DNRC has coordinated BMP audits using this process every two years since 1990.

The results of the audits show that application and effectiveness of BMPs has steadily improved for all ownership groups over the last decade. Results of the 2000 and 2002 audits indicate adequate application of BMPs on 96% of all practices rated compared to 78% in 1990. The effectiveness of these practices in providing adequate resource protection was rated at 97% in 2000 versus 80% in 1990 for all ownership groups.

DNRC timber harvest sites have consistently scored the highest among ownership groups throughout the history of the Statewide BMP audits. Results from the DNRC sites audited in 2002 rated BMP application at 98% and BMP effectiveness at 99%. Results of BMP audits completed on DNRC harvest sites during 1996, 1998 and 2000 are similar. Internal BMP audits completed by a DNRC hydrologist and soil scientist have produced

similar conclusions.

No further analysis of this concern will be made.

Wildlife

- **Retention of overstory cover and movement corridors is a concern because harvest may remove cover and can decrease habitat security for some species.**

Harvest can render habitats less suitable or unusable for species such as big game, lynx, fisher and marten. This is particularly important where overstory canopy cover has been altered in the surrounding landscape. This issue will receive further analysis in Chapters 3 and 4

- **Recruitment of large-sized snags and coarse woody debris is a concern because harvest can remove trees that appear unhealthy from a timber producing perspective.**

With time and natural tree decline, large-sized unhealthy trees are the individuals most readily recruited into large-sized snags and ultimately, large pieces of coarse woody debris. Over 50 species of wildlife depend on snags or coarse woody debris for nesting, roosting, feeding or loafing sites. Nearly 100 species, including bats, small mammals, amphibians, furbearers, woodpeckers, raptors, passerines and waterfowl are known to use snags or coarse woody debris. To mitigate for this concern the Douglas fir and ponderosa pine within harvest units would be retained under all of the action alternatives. This issue will receive further analysis in Chapters 3 and 4.

- **High road densities decrease habitat security and quality for many wildlife species, compared to similar habitats without high road densities.**

High road densities contribute to loss of snags and snag recruits due to firewood cutting. The presence of a road allows snowmobile access in winter, even if roads are closed to vehicle traffic with a gate. If roads are closed to vehicles, unauthorized access often occurs such that security or habitat quality is compromised. For further analysis of this concern, refer to Chapters 3 and 4.

- **The proposed road building and timber harvesting could have a negative impact on the elk population, which uses this area, by reducing security cover.**

Elk security is defined as a “nonlinear block of hiding cover 250 acres in size and at least ½ mile from any open road. Collectively these blocks must equal at least 30% of an analysis unit”(Hillis et al. 1991). Thus, elk security is a function of cover and road density, parameters discussed above. The synthesis of those 2 factors will be discussed in

Chapters 3 and 4.

➤ **Habitat which is important to Moose, may be degraded by the proposed action**

An increase in hunter access due to additional roads under the action alternatives could produce a negative impact on the resident moose population. This issue will receive further analysis in Chapters 3 and 4.

➤ **The proposed action may impact threatened, endangered or sensitive animal species.**

Threatened and Endangered Species

The project area contains cover types, which could provide needed security and feeding cover for animal species of special concern. The following species and their habitat needs will be analyzed: Bald Eagle, Peregrine Falcon, Grizzly Bear, Gray Wolf and Lynx.

Preferred habitat for both the Bald Eagle and Peregrine Falcon does not occur in the project or analysis area. It is unlikely that either species would occur in the project or analysis areas. Neither species would be affected directly, indirectly or cumulatively, by any of the proposed alternatives. Further analysis is not necessary for either species.

Gray wolves (Federally-endangered) have occurred recently in southwestern Montana, and could use the proposal area. Wolves forage on small mammals and big game, and are associated with winter range areas that produce big game carrion. No winter range occurs in the proposal area. Although wolves could use the proposal area, it does not provide preferred habitat for the species. This issue will receive further analysis in Chapters 3 and 4.

Grizzly Bear and Lynx habitat does occur within the vicinity of the project so both of these species will be analyzed in Chapters 3 and 4.

Sensitive Species

Habitat offered by the project area provides opportunities for the following species to use this area. Black-backed woodpecker, flammulated owl, and boreal owl, they will be further discussed in Chapters 3 and 4.

Other Sensitive Species

The following are other sensitive species that occur on lands administered by the Southwestern Land Office. DNRC assessed potential habitat in the project area and the

Montana Natural Heritage Program Database for records of occurrence of these species. Due to limited available habitat, these species would not likely occur in or near the project area. No effects on any of these species are expected to occur as a result of this project.

Coeur d'Alene Salamander-No fractured rock, waterfalls or splash zones occur in the project area.

Columbian Sharp-Tailed Grouse-No extensive grassland or shrub-steppe habitat occurs in the project area. The only documented populations of this species in Western Montana are located near Eureka and Ovando, Montana.

Common Loon-No lakes occur in the area. This bird has been observed at Georgetown Lake during migration, located 20 miles southeast of the project area.

Ferruginous Hawk-No extensive grassland habitat occurs in the proposal area. Grassland is located southeast of the analysis area, but it would not be affected by the proposal. The bird is not listed in the Montana Natural Heritage Program database for this location.

Harlequin Duck-White-water habitat with boulder and cobble substrates is absent.

Northern Bog Lemming-No fens, bogs or substantial moss-dominated areas are present.

Mountain Plover-No extensive shortgrass prairie or prairie dog towns are present.

White-Tailed Prairie Dog-Shortgrass prairie habitat is absent. This species is only documented from near Bridger, Mt.

These Species will not receive any further analysis in Chapters 3 or 4.

Other Considerations

The northern goshawk, a species of special concern, is associated with relatively dense late-successional forests, usually in close proximity to water. Downed logs provide habitat for goshawk prey. Goshawks forage in a variety of forest structural stages including openings. The project area provides more than 2,000 acres of potential goshawk habitat. Likely areas for nests include stands near wet sites such as those located along the section line between Sections 5 and 8. Potential impacts to goshawks will be further analyzed in Chapters 3 and 4.

Soils

- **Long-term soil productivity can be reduced depending on area and degree of**

physical effects, (erosion, compaction, displacement) amount and distribution of coarse wood debris retained for nutrient cycling. This issue will receive further analysis in Chapters 3 and 4.

- **Concern was expressed that Best Management Practices (BMP's) would not be effectively implemented as part of road construction, reconstruction and maintenance.** Adequate road drainage, proper construction and reconstruction would occur, according to BMPs along with maintenance needs on existing roads. This issue will receive further analysis in Chapters 3 and 4.

Economics

- **Concern was raised that the proposed action may not adequately consider net public benefit by only looking at the value of the timber resource and that non-market goods, such as resource protection, as well as non-timber forest products, may not be adequately considered as part of the economic analysis.**

The economic analysis will included only estimates for revenue from activities that produce actual measurable dollars for the trust that are related to the proposed project area. Examples of these activities include timber harvesting, post and rail harvesting, grazing, conservation license or lease, general recreational license, etc. Benefits to the people of Montana include non-monetary factors such as protection of wildlife, water quality and air quality, and long-term integrity of the ecosystem. The economic impacts (positive or negative) on these factors from the proposed action are not discussed in the economic sections but are qualitatively discussed in other sections of the environmental assessment. The harvesting of timber will modify the undisturbed development of the forest and, as a result will affect both habitat and wildlife. The net effect of how individuals value these modifications is an empirical question and may be viewed either positively or negatively by different individuals. Various animal species will be either positively or negatively impacted depending on their habitat needs. There will be changes to the undisturbed progression of both forest and wildlife development, which would be viewed differently by different individuals. The net social benefit or loss is an empirical issue. The department feels that is not appropriate to mix estimates of dollar values for non-monetary factors with monetary factors in the economic analysis. Granite County has a long history concerning the wood products industry. During the last 20 years there have been at least 5 different sawmills, of varying size, located within the county. At the present time there is one medium size mill operating. There is a substantial amount of employment, which is associated with this mill. It is important to note that a high rate of employment generates lower rates of crime, domestic violence, alcohol/drug problems, and a healthier, more satisfied community. To the extent that No-Action Alternative A might contribute to unemployment, the social impact of the not harvesting might be a short-term negative social and economic impact on the community. Conversely, to the extent that the sale provides employment, the short-term impact would

be positive. To date the department has not received any interest in a conservation license, commercial berry picking, mushroom harvesting or any other alternative revenue producing activity for this project area.

- **Concern was raised that DNRC should consider all project-level costs and weigh these against returns to the school trust.**

Costs that are related to the timber sale program are only tracked at the Land Office and Statewide level. Project level costs for individual timber sales are not tracked individually. An annual cash-flow analysis is conducted on the DNRC forest product sales program. Revenue and costs are calculated by land office and Statewide. The revenue-to-cost ratios are a measure of economic efficiency. A ratio value less than 1.0 means that the costs are higher than the revenues (losing money). Ratios greater than 1.0 means revenues are higher than the cost (making money). A ratio equaling 1.0 means that the costs equal the revenues. Actual revenue-to-cost for the years 1995 through 2003 can be found in the Economic Section in Chapter 3. The average revenue-to cost ratio for the SWLO for this period is 2.01, which means that for every \$1.00 in cost the department produces \$2.01 in revenue. This issue will receive further analysis in Chapters 3 and 4.

Visual

- **A concern was raised that the proposed action would have undesirable visual impacts.**

Concern was expressed that the proposed action would change the view shed for the area. Most people would view the proposed sale area from the county road, which follows Upper Willow Creek. The USFS has harvested two timber sales, which contained cutting units that are highly visible from the county road. Both of these sales, Upper Willow Creek and Alder Niles, were harvested within the last 15 years. This issue will receive further analysis in Chapters 3 and 4.

Safety

- **Increased traffic from logging trucks, which would result from implementation of an action alternative, may cause a temporary increase in safety hazards for people using the Upper Willow Creek Road.**

There are several blind curves on the Upper Willow Creek road. This road appears to have been designed with little consideration for commercial traffic. Existing hazards are accentuated when logging trucks and other commercial traffic try to use the road system concurrent with residents and recreational users. Several collisions and close calls have occurred during past timber sale activity.

The U.S. Forest Service has no currently proposed timber sales within this drainage. Logging truck traffic from this source is not expected in the near future.

The State's proposed harvest of 1.5-3 MMBF would create approximately 650 truckloads of logs. In addition to the logging trucks, there would be increased pickup truck traffic from the loggers and foresters. Due to soil constraints, some of the units would be harvested during the winter, which would further increase safety concerns. This road is a county road under jurisdiction of the Granite County Commissioners. A representative from the DNRC would meet with County Commissioners to encourage them to modify the Upper Willow Creek road so it is safer for both logging trucks and the general public.

To partially mitigate this concern the DNRC would include up to \$5,000 of excavator time and blasting to assist the county in correcting the highest priority curves if an action alternative were selected. Expenditure of this money would be conditional on the county obtaining proper easements. Curves selected for corrective work would be widened and realigned to improve site radius and turn out space. By assisting Granite County with the highest priority curves, it is anticipated that some safety hazards would be reduced. This road is not under the Department's jurisdiction and mitigation's included in the action alternatives would not be a final solution for this issue. In addition to the curve widening, Temporary "Logging Trucks Hauling" signs would be posted with the "CB" channel identified. No further analysis of this concern will be done.

Vegetation

- **Timber harvest and associated road building can remove components of old growth, reduce or eliminate the function of old growth habitat, and disrupt the processes that produced and continue to maintain old growth over time.**

Habitats can be rendered unsuitable or less suitable for species that are associated with old growth. Old growth ecosystems are complex and generally require the passage of considerable time to be created. Fragmentation and loss of old growth habitat and its attendant wildlife species is a concern. This issue will receive further analysis in chapters 3 and 4.

- **With No Action health of the existing stands would continue to decline with an increased risk of insect outbreaks such as mountain pine beetle or the loss to a stand replacing fire.**

Health of the existing stands could continue to decline with increased risk of insect outbreaks such as mountain pine beetle or of loss to stand replacing fires.

Age class distribution for the stands located within the project area are substantially

different than research indicates should be present. Fire suppression for the last 80 years has created a shift in age class distribution toward older aged stands. This concern will be discussed in Chapters 3 and 4.

- **Concerns were expressed that the State would not be able to adequately regenerate the proposed harvest units.**

There have been many timber sales within the Upper Willow Creek drainage over the years. Those from the 1960's and early 1970's were concentrated in the Scotchman's Gulch, Ram Mountain and Miners Gulch area. Early sales tended to be large in extent and concentrated in over mature Douglas fir stands. Most of the early sales were also located on private land. In the mid 1970's the emphasis shifted from harvesting on private lands to public land, predominately United States Forest Service. In 1986 DNRC sold their only timber sale to date in this drainage. This sale consisted of 114 acres of clearcut harvest, and 29 acres of commercial thinning harvest. During the last three years approximately 55 acres have also been thinned by harvesting posts and rails within Sections 5, 16, and 17. DNRC's ability to regenerate harvest units has been variable. Sites dominated by lodgepole pine appear to be more successful in regenerating than those dominated by Douglas fir. Regeneration surveys conducted in 1993 and 2002 produced the following results from harvesting in Section 16, Township 8 North, Range 15 West.

TABLE 1-2
Past Success on DNRC Lands With Natural Regeneration
In the Upper Willow Creek Drainage
1993 results

UNIT NUMBER	% STOCKED *	ACRE	NUMBER OF 1/300 TH AC. PLOTS TAKEN
1	52	27	21
2	54	50	37
3	40	31	40
4	25	7	8

*percentage of 1/300th acre plots with one or more crop trees on the plot, which equals 300 trees per acre

TABLE 1-3
2002 results

UNIT NUMBER	% STOCKED *	ACRE	NUMBER OF 1/100 TH AC. PLOTS TAKEN
1	91.6	27	24
2	60	50	30
3	84.4	31	32
4	50	7	6

*percentage of 1/100th acre plots with three or more crop trees on the plot, which equals 300 trees per acre

In the spring of 1995, cutting units 2, 3 and 4 were interplanted with lodgepole pine containerized stock. Proposed harvesting under all action alternatives are designed to meet one of two silvicultural goals. 1) Harvesting that simulates a low intensity ground fire is being proposed to improve health and radial growth of the existing stand. There would be between 302 and 436 trees per acre left within thinned areas. This is an equivalent between tree spacing of 10 to 12 feet. There is no current need for regeneration in these stands. 2) Stand replacing and mixed severity fire simulation areas are being proposed to regenerate the existing stands. Mixed severity simulation areas would have most of the trees removed, mainly lodgepole pine, and would retain any Douglas fir or ponderosa pine. Pfister (1977) indicates that there may be problems, in the *Abies lasiocarpa/Vaccinium caespitosum* (ABLA/VACA) habitat types, with regeneration of Douglas fir and spruce due to frequent summer frosts. The frost problems do not seem to affect the regeneration of lodgepole pine. The presence of pine grass (*Calamagrostis rubescens*) may also cause regeneration problems due to direct competition with seedlings. Several site-specific mitigation measures would be implemented to encourage regeneration. These include, retention of 10-15 tons of woody debris per acre to provide micro sites. Bare mineral soil would be exposed on approximately 40% of each cutting unit to prepare a good seed bed. Where fiscally and mechanically feasible, broadcast burning would be used instead of dozer piling and burning. These actions are designed to provide a substantial number of microsites to encourage tree regeneration. Disease free trees, which are not cut during the harvesting operation, would be left standing. Those, which are mistletoe infested, would be cut down to reduce spread of mistletoe. Soil compaction/displacement would be kept to a minimum by allowing the dozer piling operations only when the soil moisture content is less than 20% and by using broadcast burning where economically and physically applicable. Within 5 years following the completion of the sale a regeneration survey would be conducted. If a stand has not regenerated naturally, it would be recommended for planting.

No further analysis of this issue is planned.

- **Harvesting of timber and associated construction of roads could negatively impact sensitive plant species, possibly Lady Slippers (*Cypripedium*).**

To address this concern, DNRC contracted with Lisa Schassberger-Druckenmiller, Botanist, to do an inventory for plant species of special concern within the sections involved in this project. The overall survey protocol used was an intuitive control method where the surveyor conducts an examination of specific areas within each parcel, in addition to walking through the general area. The Upper Willow Creek tracts involved in this proposal were surveyed July 8, 9, 17 and August 22, 23, 1999.

One plant species, northern golden-carpet (*Cypripedium parviflorum*) of special interest was found in the SE1/4SE1/4 Section 21, Township 8 North, Range 15 West, along

Arbuckle Gulch. This population extends from the eastern boundary of the parcel downstream to a point below the north-south two-track road. Plants occur in moss on cobble-gravel substrate within and along edges of the creek.

Recommendations provided by the Botanist were to maintain a 100-foot buffer of uncut trees on each side of the drainage where golden-carpet exists. Approximately 3 acres of land has been deferred from harvest to meet this mitigation. She also recommended that the creek bottom not be broadcast burned. These recommendations would be incorporated into an action alternative if one were selected. All of the action alternatives include realignment of an existing road in Section 28, where it crosses Arbuckle Gulch. The Botanist was contacted for recommendations on mitigation measures for the relocation of this road. Her suggestions were to locate the crossing on or slightly upstream from the existing crossing where there is less suitable habitat conducive to the occurrence of golden-carpet. This recommendation would be implemented if an action alternative were selected.

No further analysis will be done on this issue in Chapter 3 or 4.

➤ **The proposed action may lead to future salvage sales due to the wind throw of leave trees.**

Each action alternative contains two types of harvesting, low intensity and mixed severity, which could have the possibility of wind throw occurring. Healthy Douglas fir and ponderosa pine are being proposed for retention within cutting units where they occur. This type of harvesting simulates the occurrence of a mixed severity fire which would kill the thin barked lodgepole pine while allowing larger diameter thicker barked trees to survive. This type of harvesting has the highest potential for occurrence of wind throw. Trees that are to be retained make up the scattered over story and in the case of Douglas fir a suppressed under story. In the earlier Upper Willow Creek timber sale, located in Section 16, T8N, R15W, some Douglas fir were retained to ensure species diversity. Some wind throw did occur. This involved individual trees and was not widespread. Those trees, which were blown over, were left to provide for long term nutrient cycling, large woody debris and to provide micro sites for regeneration. If an action alternative is selected and wind throw were to occur an evaluation would be done of the value at risk. If there were enough value to make a salvage operation viable then it would be prepared for sale/permit. Any proposed action would be done in compliance with MEPA.

The low intensity simulation is designed to mimic a low intensity ground fire carried by grass and other light fuel which would thin the stand, generally leaving larger, older, thicker barked lodgepole pine. The DNRC has conducted this type of operation in past years in the Upper Willow Creek Valley. Results of these past operations, in terms of wind throw, have been that individual trees are tipped over, but not large patches.

Individual trees would usually not be salvaged due to their small size and low value. If a large patch were to be blown down the DNRC would evaluate the potential for a salvage sale/permit.

No further analysis of this issue will be done in Chapters 3 and 4.

- **The proposed action could cause noxious weed establishment associated with ground disturbance, road construction, reconstruction and traffic.**

This issue will receive further analysis in Chapters 3 and 4.

Recreation

- **Hunting, hiking and other recreational opportunities may be reduced if the proposed action is implemented.**

Sections 5, 8, and 17 are bounded by private land on the east; USFS on the north and west side, and on the south by the Bureau of Land Management (BLM). Road access to these tracts is from one of two directions, walking along Forest Service Road #4325 or crossing private land to the east. Ownership in Sections 21 and 28 has a similar pattern. Forest Service land adjoins trust lands to the east while the BLM owns 360 acres to the north. Remaining land to the south and west of the School Trust Land is owned by a private individual. The 80 acres located in the W1/2SW1/4 of Section 21 touches the Upper Willow Creek county road for a short distance. Lands controlled either by the USFS or BLM are open for use by the public at all times. The methods of accessing these lands are restricted by road closures. All of Forest Service Road #4325 north of its junction with Road #5156 is closed to motorized vehicles year-around unless specifically permitted by the Philipsburg Ranger District. This road has a locked Powder River gate near its road junction with Road #5156. To cross private land, permission must be obtained from the appropriate landowner. Existing roads on BLM land in Section 21 are open year around to motorized public use. Under the no action and action alternatives opportunities to access and use School Trust Lands would remain as they currently are. Individuals who possess a recreational access license and who legally access the trust lands are authorized to use the tracts in compliance with 77-1-101 through 77-1-810, MCA. There are no roads or trails on trust land within the project area that are licensed for recreation or any other specific use.

Trust lands are available for non-motorized recreational use to anyone purchasing a Recreational Use License for trust lands. Licenses are not site specific and allow use of all legally accessible trust lands. Therefore, it is very difficult to determine the amount of recreational use and income resulting from license sales for a specific area. Statewide, during fiscal year 2001, 37,818 General Recreational use Licenses were sold, producing \$491,222 in trust revenue. There is approximately 5,157,380 acres of School Trust land Statewide (Annual Report for FY 2001). Therefore an average of one General

Recreational Use License was purchased for every 136 acres of State land (5,157,380/37,818) producing an average gross revenue of approximately \$.095/acre (\$491,222/5,157,380) in 2001. Applying the Statewide average revenue/acre to State land in the project area produces estimated revenue of \$268.47 (.095 X 2,826 acres) per year from General Recreational Use Licenses.

None of the alternatives currently under analysis in this document would impact individuals' access or ability to use trust land for recreational purposes. This issue will not receive further analysis in Chapters 3 and 4.

➤ **The proposed timber sale may impact the amount of “road less” area present.**

All of the sections involved in this proposal currently contain roads of varying quality and quantity. The term “roadless” is normally used in reference to U.S. Forest Service land that meet a definition established for the management of federal lands. The State of Montana does not have a land classification of “roadless”. Action proposals, if implemented, would increase road density for most of the tracts. Analysis for this issue is contained in the wildlife section of this document. For further information refer to this section. The concern about road-less areas will not receive further analysis in Chapters 3 or 4.

Archeological

➤ **Logging and road building activity may harm cultural sites that may be present.**

A DNRC staff Archeologist conducted a cultural resource inventory of the proposed sale area. There were no sites of interest identified. Further information on this evaluation can be found in the project file. No further analysis of this concern will be done.

CHAPTER 2 – ALTERNATIVES

This chapter is intended to describe alternatives developed and considered in this EIS. The effects of implementing each alternative, including the No Action Alternative, will be summarized. Environmental consequences of each alternative are listed here for comparative purposes. More detailed information can be found in Chapters 3 and 4, which follow.

INITIAL STAGES OF DEVELOPMENT

The initial proposal and intent of this project is to treat these five tracts of school trust lands to achieve the objectives of providing the largest measurable return to the trust in the long run; providing 1.5 to 3.0 MMBF toward the Department harvest target; managing for healthy and biologically diverse forests; and managing for forest types and stand structures historically present on the landscape. This involves the proposed removal of up to 3.0 MMBF of sawlog-sized timber from 300 acres. In addition to the sawlog harvesting, up to 1200 acres of post and rail material are proposed for removal by thinning. Also included is construction of 5.06 miles of new road, 2.18 miles of existing road improvement and reconstruction and up to .3 mile of temporary road. The new and reconstructed roads would provide long-term access to these parcels.

DEVELOPMENT OF ALTERNATIVES

Upon analysis of existing conditions in the project area by DNRC specialists, the project leader, and the Decision Maker, an interdisciplinary team was formed to develop alternatives and address issues. Public comments were received and grouped into the concerns listed in Chapter 1. In addition, information on existing conditions was collected and compiled. Using this information, the decision maker along with the team met and developed a reasonable range of selectable alternatives.

Many resource concerns can be resolved by interdisciplinary development of site-specific mitigations. Resolution of the remaining unresolved concerns provides the basis for development of alternatives. There were three concerns, which drove development of the alternatives, Elk Security Cover, harvesting in stands meeting Green et al. old growth definitions and the hydrologic health of this area. To examine these concerns 3 different action alternatives were developed. Alternatives B and D were developed which emphasized retention of elk security cover and varied old growth harvesting. Alternative C maximizes timber harvest on this entry and trust return while maintaining other important forest resources.

Lodgepole pine is the dominant forest cover within both the drainage and the State's Upper Willow Creek ownership. When current age class distribution on state land in the Upper Willow Creek Drainage and throughout the unit is compared to historical distribution research done by Losensky (1993) it becomes obvious that the current distribution for the lodgepole pine stands

are skewed toward old stands. Alternatives B and C would harvest a large portion of these old stands and convert them to nonstocked for a short period of time, <5 years, and then to a 1-40 year old classification.

In Section 8 there is an existing irrigation ditch, which is generating sediment delivery to Upper Willow Creek. A plan to install a diversion structure on the ditch and to stabilize a deeply incised gully is included in Alternatives B and C but not in D. These modifications were made to reduce the potential for sediment transport to the creeks.

Three different types of harvesting would be utilized on this project: 1) Removal of all the timber to simulate a stand replacing fire. 2) Retention of all Douglas fir and ponderosa pine while harvesting all of the lodgepole pine, to mimic a mixed severity fire occurrence, and; 3) The reduction in stocking of second growth lodgepole pine stands to between 302 and 436 stems per acre which would mimic low intensity ground fires. For additional information on land treatments see Table 2-1.

STATEWIDE FOREST MANAGEMENT PLAN AND ITS ROLE IN THE ALTERNATIVES

The SFLMP was adopted in 1996, providing guidance in the management of all State forested lands. This EIS and its associated alternatives were developed through an interdisciplinary team approach, which, facilitated the incorporation of the Plan philosophies into each alternative and the proposed management activities, and mitigation's that may be involved. The hydrologic condition of watersheds, elk security cover, and old growth were driving issues in the development of the alternatives.

DESCRIPTION OF ALTERNATIVES

Alternative A - No-Action Alternative

Alternative A defers treatment in all sections within the project area at the present time. No additional revenue over what is currently being collected would be generated for the Common School Trust Account. No new roads would be built and no road improvements would be completed. Current management activities such as fire suppression and grazing would continue. Recreational uses such as hiking, hunting, and berry picking would also continue. Natural events, including plant succession, tree blow down, insect and disease outbreaks, and wildfires would continue to occur. The progression of cover types toward older less vigorous stands that are farther from historic conditions would continue. Following the appropriate level of MEPA review, timber harvesting or road building could be proposed and undertaken in the future. This alternative would not correct erosion problems associated with the ditch/gully in Section 8. This no-action alternative will be used as a baseline for comparing environmental consequences of the other three action alternatives.

Alternative B

This alternative is a combination of trust revenue generation and elk security retention. Alternative B was developed by taking issues generated from public scoping along with specialists input and modifying actions identified in the initial proposal. Mitigation measures were incorporated into this action alternative.

One of the fundamental reasons for proposing this sale is to return forested land to an age class distribution which more closely reflects historical conditions. These conditions are believed to be more sustainable in the long term. As a guide for what the historical conditions were, we used Losensky's (1993) research as a guideline. More specifically the data which pertained to historical Lodgepole pine age class distribution. When existing age class distribution was compared to research data, both on a project and unit wide level, it was apparent that the age class distribution was skewed toward older stands. This alternative would move older and middle age lodgepole pine stands into a seedling state while retaining the large old Douglas fir and ponderosa pine. Approximately 177 acres of lodgepole pine are proposed for harvesting to emulate the occurrence of a stand replacement fire. 120 acres would be harvested to emulate a mixed severity fire. Within these units the lodgepole pine would be removed while most of the Douglas fir and ponderosa pine would be retained. In addition to moving these stands toward a seedling condition, we are hoping to increase the ponderosa pine and Douglas fir in the regenerated stands. In talking with long-time residents in the valley, (personal communication with Hans and John Luthje) they described forests with a larger ponderosa pine and Douglas fir component. There is evidence of past low intensity ground fires occurring within the stands. To mimic these occurrences, approximately 667 acres would be thinned using post and rail harvesting. Stand density would be reduced to between 302 and 436 residual trees per acre. Within this 667 acres there are small patches of 60-80 year old trees, which are so stagnated from overcrowding that their crowns have been reduced to the point, <30% of the total tree height. They are unlikely to respond to thinning. Up to 10% of the 667 acres, or 67 acres, would have all the trees removed. These harvest patches would be less than 5 acres in size.

Access would be provided by the construction of 5.06 miles of new road, reconstruction of 2.18 miles of existing road and construction of .3 miles of temporary road. Existing access for this proposed sale is by USFS and BLM road systems that connect into the Upper Willow Creek County Road.

There are several water quality problems associated with a ditch system that DNRC inherited from the BLM in a land exchange. The ditch dewater lower Beaver Creek, a historic fishery. Where the ditch is dropped into Bear Creek there is a severe erosion and sediment problem. For most of the year Bear Creek flows approximately twice the amount of water it would under more natural conditions. Part of the proposed project is to address these problems.

This alternative retains approximately 500 acres of untreated cover for elk security, which are located in two blocks of approximately 250 acres each, located in Sections 8 and 5. The road system is designed to avoid this area and maintain the security value by using the existing federal agency road system. The number of potential live stream crossings is substantially reduced

compared to the other action alternatives. Ditch control measures would be implemented and the gully back sloped and stabilized.

Alternative C

Direct economic return to the Trust is emphasized under this alternative.

Sawlog harvesting proposed under this option is identical to the harvest described under Alternative B. The difference involves the acres of post and rail thinning removal and the amount retained for elk security cover. Approximately 1018 acres of the second growth timber would be thinned by post and pole harvesting using low impact equipment such as 4 wheelers, small dozers and pick-up trucks. As with Alternative B up to 10 percent of the 1018 acres would have all of the trees removed in small, <5 acre patches. These small patches are at locations where the dominant trees are so badly suppressed that it is unlikely they would respond to being opened up. The two large blocks of retention that were identified for elk security cover under Alternative B would receive more intensive management and would no longer meet the Hillis et al (1991) definition. Corridors along Bear Creek and Beaver Creek would remain untreated but would also not meet the security cover criteria established by Hillis et al. (1991).

Road construction needs would be somewhat different under this alternative. A bridge would be placed across Beaver Creek and the roads proposed under Alternative B for Sections 8 and 5 would be connected.

Alternative D

This alternative emphasizes retention of all stands which meet the Green et al (1992) definition for old growth. In contrast to Alternatives B and C, road locations were moved and units deleted to avoid disturbance in old growth stands. This has reduced the overall acres of harvesting, both for sawlogs and post/rail material. Sawlog harvesting would decline from 297 acres to 173 acres. The largest change in sawlog harvesting occurs in Section 5 where a 73-acre harvest simulating a stand replacing fire, is eliminated. In Section 17, Unit Number 1 (9 acres) and Number 2 (15 acres) are eliminated under Alternative D.

With a reduction in harvest acres there is an accompanying reduction in the amount of road. Alternatives B and C require 5.06 miles of new road construction, this would be reduced to 4.38 miles. The amount of reconstruction would remain the same while temporary road use would increase by .2 miles to .3 miles.

Post and rail harvesting under Alternative D is identical to B except for a 36-acre harvest unit, which is deleted, in the NE ¼ of Section 5. There is a substantial amount of change from Alternative C to D. Under Alternative C 1018 acres of post and rail material would be thinned while under D only 638 acres would be thinned. This amount is similar to the thinning identified under Alternative B. Most of the acres deferred from harvesting are located in Sections 5 and 8.

Approximately 136 acres of harvesting simulating stand replacing and mixed severity fire events,

which are proposed under B and C, would not occur under D.

The erosion and dewatering problems, which Alternatives B and C propose to address, would not be financially feasible under this alternative. The headgate structure would not be installed where the ditch intersects Beaver Creek.

The two 250-acre patches of elk security cover would be retained as identified under Alternative B. The difference between B and D, in terms of elk security cover is that under D there would be a road, which bisects the Southern block. The road would be gated and locked where it meets USFS Road 4325 and again where 4325 meets 5156, Miners Gulch Road.

MITIGATIONS COMMON TO ALL ACTION ALTERNATIVES

Water Quality

- All SMZ and water quality laws would be complied with as well as any other applicable federal, state, or local laws.
- Implement Forestry BMPs as the standard for all operations associated with action proposals.
- Plan, design and improve existing road systems to meet long-term access needs and to fully comply with BMPs. Identify existing sources of sediment associated with the road system and correct them to improve water quality.
- Comply with all stipulations set forth in the Department of Fish Wildlife and Parks 124 permits.
- Stream crossings and selected road segments would require pit-run gravel surfacing to improve bearing capability, reduce rutting and control sediment.
- A diversion structure would be installed where Beaver Creek is diverted in Section 5 to control the amount of flow in the ditch system under Alternatives B and C and D.

Roads

- Provide for adequate road surface drainage on all temporary or abandoned roads when no longer in use so that periodic maintenance will not be required.
- Insure that proper and adequate road drainage such as drain-dips are installed in all roads.
- All newly constructed roads would have adequate drainage maintained during use and access would be controlled with gates.
- All road and harvest unit locations would be reviewed by a DNRC hydrologist and soil

scientist for application of appropriate BMPs and site-specific design considerations.

Wildlife

- If any threatened or endangered species are encountered during project planning or implementation, activity would cease and the situation would be evaluated for protection needs. The SWLO wildlife biologist would be contacted to provide recommendations on appropriate measures to be implemented.
- If owl or other raptor nests were located during planning, the SWLO wildlife biologist would be contacted for recommendations on necessary mitigation. If any nests were located after the sale was sold, activities would cease in the immediate vicinity of the nest until the biologist and sale administrator could visit the site and develop any necessary mitigation measures.

Harvest Units

- Use of designated skid trails and equipment restriction zones to avoid damage to sensitive areas (i.e. wet areas, seeps, bogs, sensitive soils etc.) would be implemented.
- On wet sites and abrupt draws, equipment restriction zones (ERZ's) would be marked and maintained as needed based on site-specific review. Any trees that are removed from the ERZ's would be winch lined out. Any localized moist sites within harvest units would be protected by ERZ's or by limiting operations to winter when frozen ground or adequate snow cover protects the area as determined by site-specific review.
- Harvest units would be regenerated as soon as possible.
- Connectivity of densely forested patches would be maintained where possible.

Weeds

- All road construction and off road harvesting equipment would be cleaned of plant parts, seeds, and mud to prevent introduction of noxious weeds. Equipment would be subject to inspection by the forest officer prior to moving on site.
- Disturbed road and landing sites would be promptly revegetated with a site adapted weed-free mixture of grass seed.

Soils

- Equipment and hauling operations would be limited to periods when soils were relatively dry (less than 20%), frozen or snow covered to minimize soil compaction rutting and maintain drainage features. Soil moisture conditions would be checked prior to equipment start-up. Some moister conditions would be accepted on harvest units where

tractors remain on designated trails and timber would be winched to trails.

- The logger and sale administrator would agree to a general skidding plan prior to equipment operations. Skid trails should maintain an approximate 75 ft. spacing.
- Scarification during slash disposal would be limited to 30-40% of harvest units. No tractor piling would take place on wet areas or slopes over 35%. Broadcast burning with moderate burn intensity would be preferred for slash disposal and site preparation. Lopping and scattering of slash or jackpot burning would be used on slopes over 35%.
- On regeneration harvest areas 10-15 tons/acre of large woody debris would be retained as feasible for nutrient cycling and long-term soil productivity. On selective harvest areas 5-10 tons of coarse woody debris would be retained. Every effort would be made to retain the majority of treetops and fine litter on site as is feasible during harvest operations, for nutrient cycling. Where whole tree harvesting is used one of the following would be required to assure nutrient cycling: 1) Use in woods processing equipment that leaves slash on site, 2) Return skid slash and evenly distribute within the harvest unit. Slash should be return skidded as part of harvest operations and should not be stockpiled at landings over winter, due to the leaching of nutrients and loss of needles.
- An excavator would be required for installation of several culverts (refer to hydro report) and for pioneer road construction on steeper slopes.
- On newly constructed roads, some minor cutslope sloughing is expected to require continued road maintenance (mainly grading) during the timber sale. Cutslopes would be sloped at a ratio of ¼ to 1 for rock and 1 to 1 for common material to encourage establishment of revegetation. All newly disturbed road-cuts would be revegetated with site-adapted grasses.

COMPARISON OF ALTERNATIVES

Alternative A - No-Action Alternative

As previously stated, this alternative will be used as the baseline for comparing the environmental consequences of the other three action alternatives, because it defers treatment of all sections at this time. Existing conditions would remain primarily the same. Measures, which are proposed for implementation to correct the ditch erosion in Section 8, would not occur. Existing 4-wheel drive roads would continue to be used along with the ford across Bear Creek. The diversion structure on Beaver Creek that would regulate seasonal flow in the Beaver Creek channel would not be installed. The second growth lodgepole pine in Sections 5, 8, and 17 that currently provide summer and fall security cover for elk would continue to do so under the No Action Alternative. The amount of exposed bare mineral soil would be less thus the potential for spreading State listed noxious weeds would not increase except along existing roads and off road vehicle travel routes.

Alternatives B, and C

Under these alternatives, timber harvesting, road building, and other associated management activities would occur. Table 2-1 below summarizes environmental effects of each of the alternatives. Alternatives B & C make use of existing roads on U.S. Forest Service and Bureau of Land Management land to access the school trust lands. Alternative B retains two blocks of land, which meet the requirements of the Hillis et al. (1991) paradigm for elk security cover. Alternative C emphasizes more intensive management of the trust lands for economic return from timber harvest. No large blocks of security cover were retained but there would be corridors of hiding cover along Bear and Beaver Creeks in which little or no harvesting occur.

Alternative D

This alternative avoids harvesting or road building within any stands which meet the Green et al. (1992) definition of old growth. This reduces the number of acres proposed for sawlog harvest, along with the acres of post and rail harvesting. It also reduces the amount of new road to be built. Revenue to the trust is reduced when compared with Alternatives B and C but is greater than A. There is additional elk security cover available but fewer acres of second growth lodgepole pine, treatment. There are also no plans to install the diversion head gate on Beaver Creek or reclaim the gully erosion in Bear Creek. A more detailed explanation of existing conditions and environmental consequences can be found in Chapters 3 and 4.

TABLE 2-1
Comparison of Environmental Effects by Proposed Alternative

Item	Alternative A	Alternative B	Alternative C	Alternative D
Stand replacement harvest	0	177 ac.	177 ac.	89 ac.
Mixed severity harvest	0	120 ac.	120 ac.	72 ac.
Low Intensity (post and rail) harvest	0	667 ac.	1018 ac.	638 ac.
Estimated sawlog volume removal	0	3 MMBF	3 MMBF	1.5 MMBF
Total harvested acres	0	964 ac.	1315 ac.	799 ac.
New Road Construction	0	5.06 mi.	5.06 mi.	4.38 mi.
Road Reconstruction	0	2.18 mi.	2.18 mi.	2.18 mi.
Temporary Road	0	.1 mi.	.3 mi.	.3 mi.
% of Ownership Receiving Treatment	0	52	72	44
Risk of Insect Attack	Moderate	Low	Low	Moderate
Risk of Noxious Weed Spread	Low	Moderate	Moderate	Moderate
Cumulative WYI*	< 1%	< 1%	< 1%	< 1%

Water quality	No improvement to existing problems	Spring flows reduced in the Ditch. Ditch erosion in Section 8 repaired.	Spring flows reduced in the Ditch. Ditch erosion in Section 8 repaired	Limited improvement to existing problems
Ditch repair	No improvement to existing problems	Spring Flows Reduced in the Ditch. Ditch Erosion in Sec. 8 repaired.	Spring Flows Reduced In the Ditch. Ditch Erosion in Sec. 8 repaired.	Limited improvement to existing problems
Effects to Soil Productivity	None	Minimal	Minimal More disturbance than Alt. B	Minimal
% of Elk Analysis Area in Security Cover **	36.6	34.4	34.1	34.5
Effects to recreational hunting	None	Minor	Moderate	Minor
Harvesting in Old Growth (acres)	0	166.8	166.8	0
Estimated Net Revenue to the State ***	0	\$395,700	\$455,400	\$206,100

*ECA - Equivalent Clearcut Acres and WYI - Water Yield Increase are discussed in more detail in Chapters 3 and 4.

**Elk Security cover analysis was based on a total analysis area of 29,119 acres and is also analyzed in Chapters 3 and 4.

***Stumpage was estimated to be \$102.97/MBF for sawlogs under Alternatives B & C and \$87.64 for Alternative D. \$150/acre for post and rail material was assumed as the stumpage for all three-action alternatives.

PREFERRED ALTERNATIVE

The preferred alternative is identified here to indicate the project leaders preferred direction and will be the project leader's recommendation to the decision maker.

Alternative C is the preferred alternative because it best meets the project objectives. It would produce the largest amount of revenue for the trust on this entry and would improve health, growth, and vigor in the stands that receive treatment. The proposed treatments would also

promote biological diversity in these forests that have experienced a severe decline in the number and intensity of fires. The three main issues that drove development of alternatives were elk security cover, harvesting in old growth, and hydrologic health of the area. Alternative C does reduce the amount of elk security cover available within the analysis area, but not below threshold levels identified by Hillis et al. (1991). Approximately 166.8 acres out of 189.9 acres, which meet Green et al. Old Growth Definition, would be harvested. This alternative also repairs the ditch erosion problem on Bear Creek and reduces other potential sediment delivery to Upper Willow Creek and its tributaries. It would provide long term access for future management of these school trust lands, while protecting and enhancing existing resources.

FIGURE 2-1

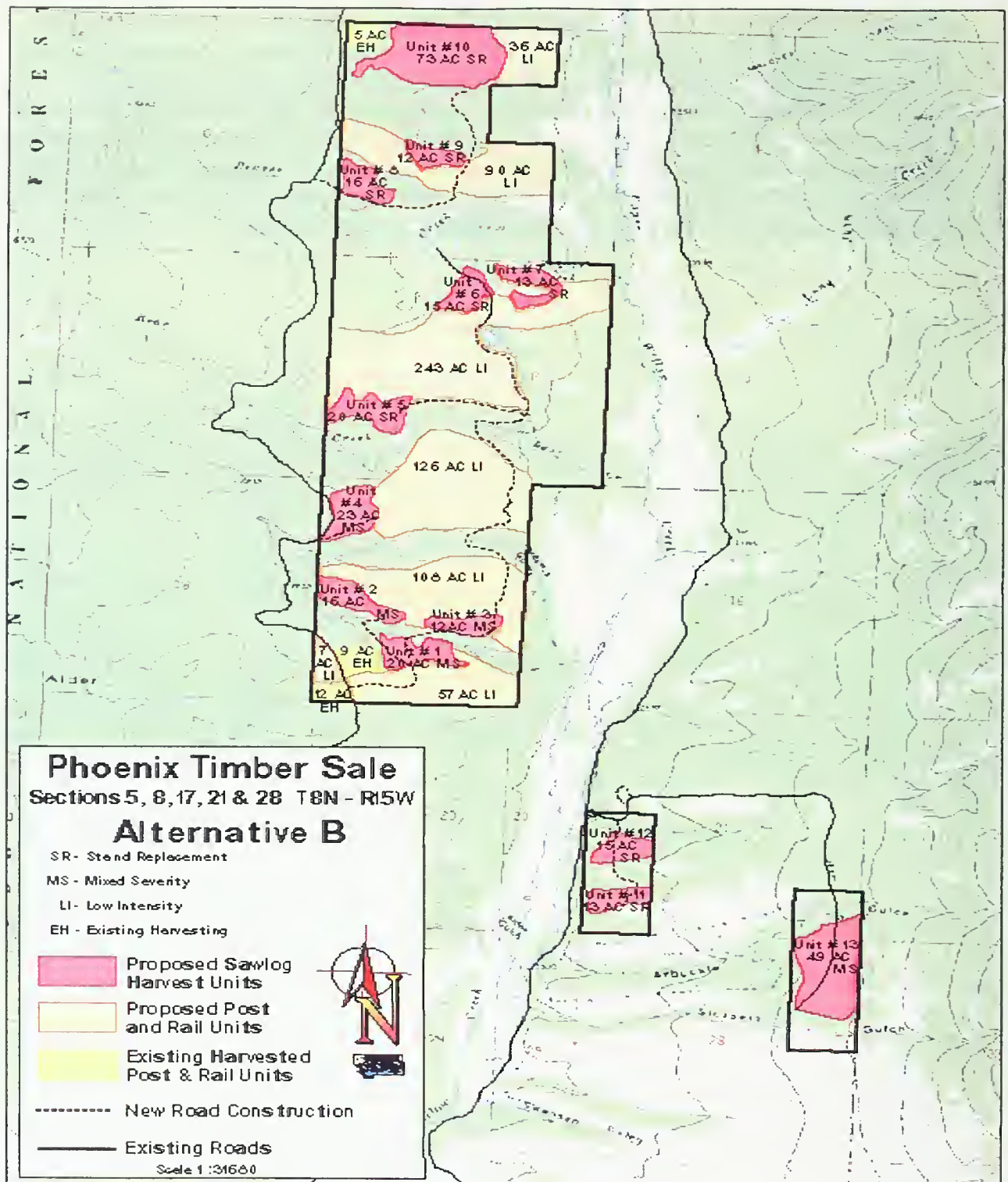


FIGURE 2-2

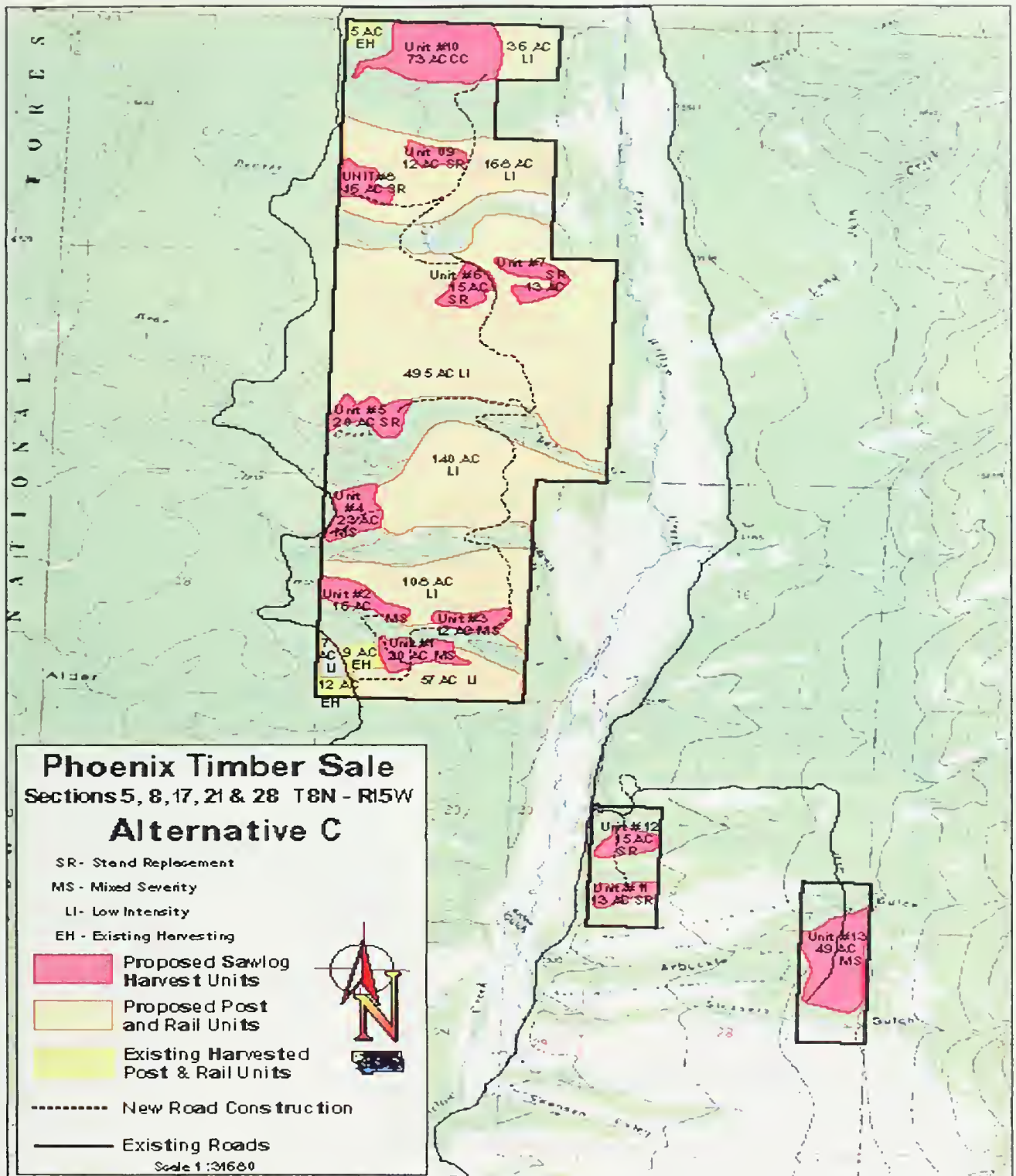
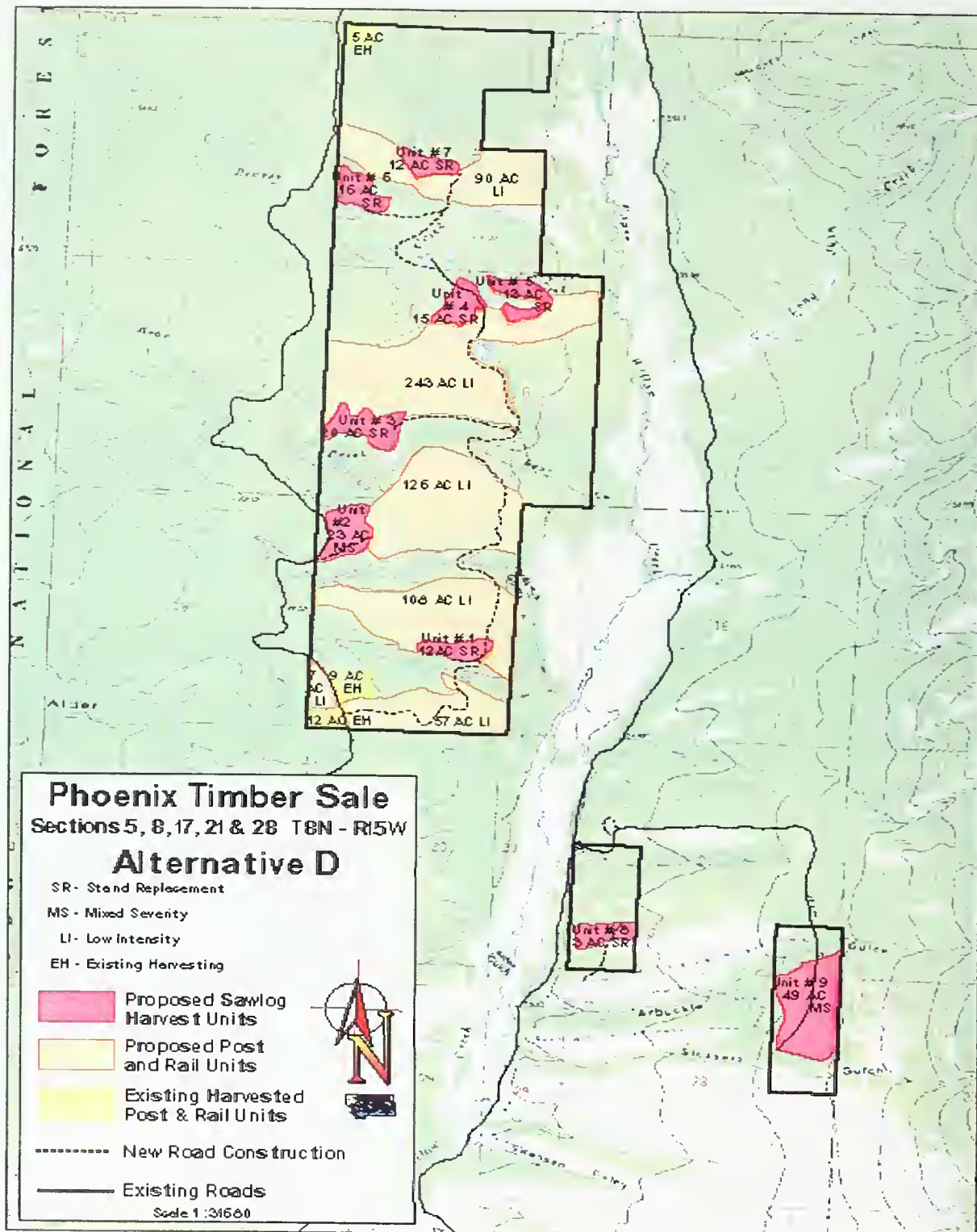


FIGURE 2-3



CHAPTER 3 – AFFECTED ENVIRONMENT

This chapter identifies and describes those resources, which are affected by the proposed action. This chapter is organized by general resource categories and their associated issues. It does not describe any effects of the alternatives, as these will be covered in Chapter 4. The descriptions of the existing environment found in this chapter can be used as a baseline for comparison of the alternatives and their impacts in Chapter 4.

GENERAL DESCRIPTION OF THE AREA

The proposed Phoenix Timber Sale is located in the western foothills of the Continental Divide,



northwest of Philipsburg, Montana. Elevations in the proposed harvest area vary between 5440 to 5920 feet. These parcels drain to tributary creeks of Rock Creek, which in turn is a tributary to the Clark Fork River. School trust lands involved in the proposed project are forested mainly with lodgepole pine along with minor amounts of Douglas fir

and ponderosa pine.

Two habitat types dominate the project area Douglas Fir/ Dwarf Huckleberry (PSME/VACA) and Subalpine Fir/Dwarf Huckleberry (ABLA/VACA). PSME/VACA occurs on dry ridge tops and south facing slopes. ABLA/VACA habitat types are found on the north facing, moister, colder slopes. Understory vegetation on the warm, dry sites is dominated by pine grass, elk sedge, dwarf huckleberry and kinnikinnick. On cool moist sites the ground vegetation is generally composed of dwarf huckleberry, grouse whortleberry, pine grass and twin flower (Pfister et al. 1977). South facing slopes within the project area contain stands, which appear to have been, at one time, a mixture of grassland and timberland. The grasslands (annual and bunchgrass types) in the project area are experiencing encroachment by Douglas fir and lodgepole pine. This is likely due to the lack of frequent wildfires, which historically kept south and west aspects clear of all but scattered individual Douglas fir (Gruell, 1983).

School Trust Lands involved in the gross sale area total approximately 1786 acres. General stand vigor ranges from poor to fair. Mature and old stands of lodgepole pine in Sections 5, 17, 21 and

28 are infected with Dwarf Mistletoe (*Arceuthobium americanum*). There is little insect activity currently in any of the stands, but there is an increasing susceptibility to Mountain Pine Beetle (*Dendroctonus ponderosae*) (Hopkins (Hagle et al. 1987) in the lodgepole pine.

Cumulative Impacts of Past Activities

Only three small patches of timber totaling 26 acres have been harvested from the project area by thinning, for post and rail materials within the last 15 years. The remainder of the project area has not had any harvesting activity.

Most timber harvesting within the drainage occurred prior to 1978 with a majority of the earlier harvest having occurred on private land in the vicinity of Scotchman and Miners Gulch. In the 1980's, harvesting shifted to U.S.F.S. land west of Upper Willow Creek near Alder, Niles, and Standish Creeks.

Two groups control access to the School trust lands. U.S.F.S. Road #4325 is a high quality road under jurisdiction of the Deer Lodge/Beaverhead National Forest that provides access to Sections 5, 8, and 17; and the BLM, which controls access to trust lands in Sections 21 and 28. These tracts can also be accessed from a county road east of Upper Willow Creek. This access would require crossing private property and crossing Upper Willow Creek. These roads are generally closed during the entire year to the public except for walk-in hunting in the fall. Past and present uses of the proposed project area include grazing, timber production, and mineral exploration.

AFFECTED RESOURCES

Hydrology and Fisheries

Watersheds

The proposed timber sale is located in the Upper Willow Creek drainage near Philipsburg, Montana. Upper Willow Creek is a fourth order perennial tributary to Rock Creek in the Upper Clark Fork River Basin. The proposed activities are located across 5 different parcels of School trust land that are drained by several tributaries to Upper Willow Creek. These tributaries include: Beaver Creek, Bear Creek, Huepeck Gulch, Arbuckle Gulch, Slusser Gulch, an Unnamed Tributary in Section 17 and an Unnamed Tributary in Section 21.

Beaver Creek is a second order perennial tributary to Upper Willow Creek with a watershed area of approximately 1,648 acres. Ownership within the drainage is predominately U.S. Forest Service. The headwater portion of the drainage is entirely U.S. Forest Service land. The Lower portions of the watershed are under both State and private ownership.

Stream flows from Beaver Creek are completely diverted into a man-made irrigation ditch at a point located on trust land in the SW1/4 of Section 8. The diversion consists of an earth berm that blocks off the natural stream channel. There is no headgate structure controlling the rate of flow into the ditch. The irrigation ditch flows through a series of small pothole ponds as it flows

south across a moderately sloped hillside toward Bear Creek. As the ditch approaches a deep draw containing Bear Creek, it descends straight down a moderately steep slope. This segment of ditch has undergone severe and extensive erosion that has resulted in the formation of a deep down cut gully. Downstream of the steep head cut section the ditch flows directly into the Bear Creek stream channel. The combined flows of the irrigation ditch and Bear Creek are then partially diverted into a continuation of the ditch system. At certain times of the year (for example during haying season) the ditch is dammed off and all of the ditch discharge originating from Beaver Creek is diverted down the Bear Creek stream channel.

Bear Creek is a second order perennial tributary to Upper Willow Creek with a watershed area of approximately 1,015 acres. The headwater's portion of the watershed is located within the Deerlodge National Forest while most of the lower watershed is under State ownership. Flows from Bear Creek are also heavily diverted for use in flood irrigation.

Huepeck Gulch is a first order intermittent drainage with a watershed area of approximately 397 acres. The main drainage feature on trust land (as delineated on USGS quad) consists of several reaches of discontinuous and poorly defined channel scoured out of a broad grass filled swale.

Arbuckle Gulch is a first order intermittent tributary to Upper Willow Creek with a watershed area of approximately 595 acres. Ownership is mixed between USFS, State and private land. At one time, flows from Arbuckle Gulch were diverted into an irrigation ditch that runs adjacent to and below the main county road. A cement tile pipe has been placed across the ditch and currently allows discharge from Arbuckle to pass over the ditch and out onto a pasture located down slope. It is unknown if seasonal flow from runoff is continuous to Upper Willow Creek.

Slusser Gulch is a first order intermittent stream with a watershed area of approximately 383 acres. Land ownership in the watershed is mostly USFS and private. The DNRC administers only about 38 acres of trust land within the watershed.

The Unnamed Tributary flowing through Section 17 is a first order ephemeral stream with a total watershed area of approximately 324 acres. A portion of the main drainage feature does contain a discernable stream channel. Other segments, including State owned Section 17, contain a barely discernable stream channel. However, the lower reaches of this drainage feature are discontinuous with the stream channel disappearing in a pasture approximately 200-250 feet up slope of Upper Willow Creek.

The Unnamed Tributary draining Section 21 is also a first order ephemeral draw that has a poorly defined and discontinuous channel. The drainage area of the draw is approximately 278 acres. The draw bottom does not contain a discernable stream channel with well-defined banks or a scoured substrate.

Regulatory Framework

The Upper Willow Creek drainage, including Beaver Creek, Bear Creek, Huepeck Gulch, Arbuckle Gulch, Slusser Gulch and the Unnamed Tributaries in Section 17 and Section 21 are all

classified B-1 in the Montana Surface Water Quality Standards. Waters classified B-1 are suitable for drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

Among other criteria for B-1 waters, no increases are allowed above naturally occurring concentration of sediment which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish or other wildlife. Naturally occurring includes conditions or materials present from runoff or percolation from developed land where all reasonable land, soil and water conservation practices have been applied. Reasonable land, soil, and water conservation practices include methods, measures, or practices that protect present and reasonably anticipated beneficial uses. These practices include but are not limited to structural and non-structural controls and operations and maintenance procedures. Appropriate practices may be applied before, during, or after pollution producing activities. The State has adopted Forestry Best Management Practices (BMP) through its Nonpoint Source Management Plan as the principle means of controlling nonpoint source pollution from silvicultural activities.

The Upper Willow Creek drainage has been identified as a water quality limited water body in the year 2002 update to Montana's 303(d) list. Major causes of impairment include chronic dewatering, channalization, bank instability, and reduction of riparian woody vegetation.

The Montana Streamside Management Zone Law (77-5-302 MCA) and rules regulate forest practices that occur adjacent to streams, lakes and other bodies of water. The law prohibits or restricts timber harvest and associated activities within a width of SMZ that varies from 50-100 feet either side of a stream, depending on the steepness of slope and the class of stream.

The Montana Stream Protection Act (87-5-501 MCA) regulates activities conducted by government agencies that may affect the bed or banks of any stream in Montana. The law provides a mechanism to require implementation of BMPs in association with stream bank and channel modifications carried out by governmental entities. Agencies are required to notify the DFWP of any construction projects that might damage or modify the natural existing shape and form of any stream.

Cumulative watershed effects – Existing Conditions

Principal land use activities within the Upper Willow Creek watershed are forestry, livestock grazing, hay production, dispersed recreation and home sites. Past human related disturbances include road construction, stream diversion and de-watering, riparian clearing, mining, timber harvest, and heavy riparian livestock grazing.

A moderate level of timber harvest and road construction has occurred within the watershed in the recent past. Approximately 5,606 acres of timber harvest has occurred in the Upper Willow Creek watershed since 1965. Most of this harvest occurred prior to 1978 with a majority of the earlier harvest having occurred on private land. Overall timber harvest on private land has

accounted for some 2,316 acres of activity. The BLM has harvested a total of 874 acres. The only harvest activity by the DNRC in the last several decades was 144 clearcut acres in 1986 and 35 acres of post and pole thinning in the 1990's. The USFS has harvested a total of 2,237 acres in Upper Willow Creek drainage. 1,384 acres of the USFS harvest total are the result of the recent post and pole harvest, and the Alder-Niles and Upper Willow Timber Sales.

The total acres harvested and miles of road constructed in Upper Willow Creek and each tributary affected by the proposed action is summarized in the following table:

**Table 3-1
Existing Timber Harvest and Road Construction**

WATERSHED	Total Size (Acres)	Area Harvested (Acres)	Roads Built (Miles)
Upper Willow Creek	61,451	5,636	137
Bear Creek	1,009	16.5	1.2
Beaver Creek	1,755	86	1.1
Huheck Gulch	397	74	0.5
Unnamed Tributary (Sec. 17)	324	94	0.7
Unnamed Tributary (Sec. 21)	278	48	1.3
Arbuckle Gulch	595	0	2.1
Slussers Gulch	383	0	0.9

Harvest history and road data were compiled using information obtained from the Deerlodge National Forest Timber Stand Management Record System, Bureau of Land Management timber sale records and timber sale contract maps, DNRC timber sale records and contract maps, USFS aerial photography, DNRC Hazard Reduction Records and from field reconnaissance and field mapping completed by DNRC hydrologist.

Watershed analyses were completed for the entire Upper Willow Creek watershed and all of the affected tributaries listed in the table above. These analyses were completed to determine the existing watershed conditions and the potential for cumulative watershed impacts.

The watershed analysis completed for the entire Upper Willow Creek drainage utilized the WATSED computer model. Region 1 of the U.S. Forest Service and the Montana Cumulative Watershed Effects Cooperative developed the WATSED model. The WATSED model estimates natural water yield and sediment yield, and predicts increases in water and sediment yields due to road construction and timber harvest. Sediment yield coefficients used were adopted and

correlated from information provided by the Deerlodge National Forest Land System Inventory, Natural Resource and Conservation Service soil surveys, and field mapping completed by a DNRC soil scientist. The results of that analysis are summarized in the following table:

**Table 3-2. WATSED
Results for the Upper Willow Creek Drainage**

Watershed	Natural Runoff (acre-ft)	Existing ECA (acres) *	% WYI **	Peak Flow Increase %	Increase Sediment %
Upper Willow Cr.	30,211	3,622	3	3	35

* Equivalent Clearcut Area (ECA) is calculated by the WATSED model as a function of area (acres) treated, % of forest crown removed and estimates on the amount of hydrologic recovery due to vegetative re-growth. Recovery values were verified and adjusted by observations made in the field.

** WYI refers to estimated % water yield increase due to forest crown removal.

The WATSED model was not used for cumulative watershed effects analysis in Beaver Creek, Bear Creek, Huepeck Gulch, Slusser Gulch, Arbuckle Gulch and the two unnamed tributaries. However, the area covered by these watershed analysis areas is included in the modeled results for the entire Upper Willow Creek Watershed. The WATSED model was not used for these sub-watershed analysis areas due to one or more of the following reasons: 1) These watersheds have intermittent, ephemeral or discontinuous flow regimes; 2) A lack of well defined stream channels or lack of continuous stream channels; 3) These are low ordered streams with small drainage areas, and 4) The low levels of existing timber harvest and low road densities within the sub-watershed analysis areas.

Potential water yield increases were analyzed in these tributaries using the Equivalent Clearcut Area (ECA) methodology as outlined in Forest Hydrology Part II (Region 1 - USFS, 1974). Sediment yields were analyzed using intensive ground surveys carried out to identify existing and potential sources of erosion and sediment delivery. The results of water yield analysis using the ECA methodology are summarized in the following table:

**Table 3-3
Water Yield Analysis Upper Willow Tributaries**

Watershed	Flow Characteristics	Existing ECA (Acres)	% of Watershed in ECA	% WY Increase
Bear Creek	Perennial	11	1.2	0.6
Beaver Creek	Perennial Diverted	40	2.3	0.7
Hupeck Gulch	Intermittent	46	11.5	4.6
Unnamed Trib. (Sec. 17)	Ephemeral Discontinuous	46	14	4.3
Unnamed Trib. (Sec.21)	Ephemeral Discontinuous	21	7.4	2.7
Arbuckle Gulch	Intermittent	6	1.0	0.6
Slusser Gulch	Intermittent	3	0.7	0.4

Existing water yield increases in all of the watershed analysis areas are predicted to be well below those levels normally associated with detrimental water yield increases. Detrimental water yield increases are levels of water yield increase associated with increases in the magnitude and duration of peak flows which might cause or contribute to channel down cutting, channel scour, or other forms of channel instability. Water yield modeling results show low levels of water yield increase in Bear Creek, Beaver Creek, Arbuckle Gulch and Slusser Gulch. Predicted levels of existing water yield increase are less than 1 % over natural conditions in all of these watershed analysis areas. Results indicate moderate levels of water yield increase in Hupeck Gulch (4.6%) and the Unnamed Tributary in Section 17 (4.3 %) and Section 21 (2.7 %). However, these three drainage areas contain ephemeral and discontinuous flow regimes with stable stream channels and ephemeral draw bottom.

Predicted water yield increases are also well below thresholds set for each watershed analysis area by a DNRC hydrologist. Threshold levels were specifically established for each watershed analysis area using a risk matrix. Under this process thresholds are determined by considering acceptable levels of risk, watershed sensitivity (flow regime and channel conditions) and downstream resource values (beneficial uses). Thresholds for allowable increases in water yield were set at 8% for Upper Willow Creek, Beaver Creek and Bear Creek, and 12% for all of the remaining watershed analysis areas.

Existing cumulative watershed impacts appear to be largely associated with localized sources of increased sediment delivery within Upper Willow Creek and the Sub-watershed analysis areas. A DNRC hydrologist and soil scientist completed detailed sediment source inventories for the State's ownership in these watersheds. The results of these surveys are contained in the Hydrology Project files and are discussed in the section addressing "Water Quality".

The largest identified sediment source is an irrigation ditch located on trust land in the Bear Creek watershed. Large volumes of sediment were once delivered to Lower Bear Creek from headcutting and gully erosion that occurred on the irrigation ditch during the last 40-50 years. An estimated 650 cubic yards of fine materials were eroded out of the gully system and transported directly to lower Bear Creek during this time.

Increased water yields caused by the diversion of the discharge of Beaver Creek into the lower reaches of Bear Creek have also contributed to instability. Lower Bear Creek is subjected to the combined flows of Beaver Creek and Bear Creek during much of the year due to a lack of headgate control at a diversion structure on Beaver Creek. Increased flow has the greatest potential impact during peak runoff when the additional discharge to Bear Creek may result in increased bank scour and channel degradation.

Other identified sources of sediment in Beaver Creek and Bear Creek include the US Forest Service Road #4325 and several lower standard roads located on private and State land. Channel instability and sediment delivery is also evident due to extensive livestock grazing and riparian vegetation clearing on private land downstream of the State ownership.

Stream Channel Stability

All stream channels and well-defined ephemeral drainage features within the proposed sale area were inventoried and evaluated in the field in 1993 and 1999. Individual stream reaches were delineated and classified using Rosgen's morphological descriptions (Rosgen 1996). Channel conditions and stability were rated using the Pfankuch method outlined in Forest Hydrology Part II, USFS 1974.

Channel conditions on State ownership in Beaver Creek and Bear Creek were rated as being in good to excellent condition. Both streams are dominated by reaches of B4 channels that were evaluated as being in relatively stable condition. There is evidence of bank trampling from past cattle use in the Bear Creek. However, in 1997, DNRC constructed a fenced riparian grazing enclosure on a segment of Bear Creek that had been the most impacted. This reach was evaluated in 1999, and it was determined that the streambank had re-vegetated and most of the damage had recovered. Although there are still moderately high levels of fine sediment deposition in both stream channels.

Stream channel conditions in lower Bear Creek (downstream of the State ownership) were rated as being in fair condition. The stream banks in lower Bear Creek have more active bank cutting and are not as well vegetated with deeply rooted plants than the area upstream on USFS and DNRC lands. This is partially due to the higher levels of cattle use in and around the stream. The lower portions of the watershed are privately owned and it is more accessible and vulnerable to cattle use than the more heavily forested public lands located upstream. The present stream channel condition appears to be more stable than conditions reported in the recent past. This is based on the remaining evidence of braided channels, small headcuts and bank scour and failure. The current DNRC evaluations compared with evaluations conducted by the BLM in 1982 suggests that these channel features are stabilizing.

Other drainage features located within the proposed sale area are intermittent, ephemeral and discontinuous in nature. Most of these draws do not contain discernable stream channels. Those features containing streams as defined under the Montana Streamside Management Law and Rules contain only limited reaches of discernable stream channel. Flows from those stream reaches either go subsurface or only occur seasonally in the form of concentrated surface runoff. In either case, the draw bottoms are stable and in good condition.

Water Quality - Existing Conditions

Existing impacts to water quality within the project area are primarily associated with accelerated sediment delivery to streams and ephemeral drainage features. Detailed sediment sources surveys were completed for the trust land by a DNRC hydrologist and soil scientist. The purpose of these surveys was to identify and inventory all existing and potential sources of erosion and sediment delivery to streams on the State ownership.

Access to the proposed timber sale area is provided by existing Granite County, Forest Service, BLM road systems, and various low standard roads and trails located on private and state land. All existing roads on the State's ownership, as well as those proposed for access and timber hauling, were inventoried during the sediment source survey. The conditions of many of the existing roads in the Upper Willow Creek watershed are poor. Many of these roads, including a USFS capital investment road, do not fully comply with Best Management Practices (BMPs). These roads are substandard due to their location, steep sustained grades, unimproved stream crossings, lack of adequate drainage features and lack of general road maintenance.

Both Beaver Creek and Bear Creek have been impacted by accelerated rates of sedimentation caused by past or existing development activities. The USFS road system traversing these watersheds lacks an adequate number of ditch relief and road surface drainage features. Long reaches of road ditch are routed directly to several stream-crossing sites. This has resulted in delivery of cut-slope; ditch and road surfaces derived sediment directly into the streams. Temporary mitigation measures have been recently installed to address these problems. However, long-term solutions are still pending. The low standard roads and trails on State land within the project area contain several unimproved (drive-through) ford stream crossing. While these crossing are relatively stable and receive only low volumes of vehicle traffic, they still contribute minor levels of sediment delivery to streams.

Head cut and gully erosion occurring in the irrigation ditch diverting Beaver Creek has resulted in extensive downstream sedimentation in Bear Creek and Upper Willow Creek. This gully has been actively eroding for at least 40 years and continues to impact water quality in Bear Creek and Upper Willow Creek.

Past and current grazing practices on private land in the watershed have contributed to bank instability and subsequent sediment delivery to Upper Willow Creek. The woody riparian vegetation has been cleared from several long reaches of Upper Willow Creek.

The existing roads, current grazing practices and the unstable reaches of irrigation ditch will continue as chronic sources of sediment delivery and pose potential risk to downstream water quality and downstream beneficial uses unless improvements, mitigation and remedial action measures are implemented.

Cold Water Fisheries - Existing Conditions

Upper Willow Creek, Beaver Creek and Bear Creek all support native cold water fisheries. Fish species presence/absence surveys, population surveys, genetic sampling and habitat inventories have been completed by DNRC/FW&P for both Beaver Creek and Bear Creek.

Species Presence / Absence, Populations and Genetics

Fisheries surveys completed by U.S. Forest Service in 1994 found westslope cutthroat trout present in Bear Creek and bull trout, cutthroat trout and brook trout present in Beaver Creek. Brook trout were also present in the irrigation ditch and ponds located between Beaver Creek and Bear Creek. Fisheries surveys completed in Bear Creek and Beaver Creek by DNRC and FW&P in 2000 found bull trout, westslope cutthroat and brook trout present in Bear Creek and westslope cutthroat and brook trout present in Beaver Creek. The following is a summary of the fish population and habitat survey done by FW&P in June of 2000. Since only one-pass electrofishing surveys were completed, population descriptions only represent relative abundance and not true population size.

Fish Populations:

Bear Creek:

Bear Creek contains small populations of westslope cutthroat trout, bull trout, and a few brook trout. The low density and small size of the westslope cutthroat trout present in Bear Creek is typical of populations found in headwater streams. Since Bear Creek's elevation and severe winter conditions contribute to a short growing season and limited productivity. All the bull trout captured in the survey reach were considered juvenile fish, suggesting the bull trout in Bear Creek are part of a non-resident fluvial population. Connectivity and retention of quality habitat are critical for maintaining this population. A small number of brook trout were caught near the inflow from the Beaver Creek canal and may be out-migrants from Beaver Creek. Although brook trout represented the fewest fish captured they had greatest mean size of the three fish species sampled. Suggesting that brook trout may be able to out compete the native fish for resources. The electrofishing survey did not indicate that habitat is a limiting factor on biomass or density.

Beaver Creek:

Above the irrigation canal diversion, Beaver Creek contains westslope cutthroat, bull trout, brook trout, and bull X brook trout hybrids. The observed small sizes and low densities of westslope cutthroat trout are typical of headwater streams with populations of competing brook trout and

poor quality habitat. Also, Beaver Creek's elevation and severe winter conditions also contribute to a short growing season and limited productivity. All the bull trout captured during the survey were identified to be bull X brook hybrids. The bull trout hybrids are presumed to be part of a non-resident fluvial population. Several age classes of sexually mature brook trout were captured but at unexpectedly low densities. The low levels may be due to poor habitat conditions or low stream productivity. The establishment of brook trout in Beaver Creek is limiting native trout; by out competing westslope cutthroat and the genetic introgression with bull trout.

Habitat Inventory

Bear Creek:

Habitat parameters in Bear Creek are in excellent condition. The channel is predominately stable (>95%) with numerous undercut banks. The small numbers of unstable/eroding banks are within the range for natural fluvial conditions. This high stability provides low sediment input and clean spawning substrates for salmonids. Although fast water habitat types (riffles and runs) dominate the channel, the pool to riffle ratios is sufficient to provide adequate fish habitat. Large woody debris and meanders create most pool habitats with a few pools being created by boulders. Continued recruitment sources are crucial for maintaining this channel diversity.

Beaver Creek:

Habitat parameters in upper Beaver Creek (above the irrigation diversion) are in good condition. The channel is stable (100%) with numerous undercut banks. Although this high stability provides low sediment input, fines and small gravels are still present in substrates. Sediment sources might be originating off-site and contaminating the reach's salmonid spawning substrates. Although fast water habitat types (riffles and runs) dominate the channel in this upper area, the pool to riffle ratios is sufficient to provide adequate fish habitat. Large woody debris and boulders create most pool habitats with a few pools being created by meanders. Continued LWD recruitment sources are crucial for maintaining this channel's habitat complexity.

Habitat parameters in lower Beaver Creek (below the irrigation diversion) are in poor condition. The irrigation diversion has captured the stream's entire flow for numerous years. Immediately below the diversion the stream channel no longer exists. Since the Beaver Creek channel does not exist immediately below the diversion point, fish must migrate up the canal. The irrigation channel may act as a partial fish barrier, excluding most fish. Ground water recharging reactivates the stream channel approximately 0.5 miles down valley of the headgate and the lack of discharge has altered the channel's dimensions, patterns and profile. These lower reaches are unstable (<60% stability) with very few undercut banks (<18%). The channel's instability increases sediment inputs resulting in high concentrations of substrate fines. These conditions reduce salmonid spawning success. The pools in these reaches do not provide adequate fish habitat. The channel has little LWD with most pool habitats being created by headcuts and boulders. Reactivation of these reaches without extensive channel modifications would result in an excessive and continuous sediment supply to Upper Willow Creek. The excessive sediment would negatively impact Upper Willow Creek.

Bull Trout

Bull trout are currently listed as a threatened species under the Federal Endangered Species Act (ESA). To date, the U.S. Fish and Wildlife Service has not yet developed a bull trout recovery plan. However, the Montana Bull Trout Restoration Team has developed interim guidelines in the Immediate Actions for Bull Trout and the State's Draft Bull Trout Restoration Plan.

The Deerlodge National Forest completed a baseline conditions assessment for bull trout in the Upper Willow Creek watershed. This assessment was completed utilizing various species and habitat indicators as outlined in guidance issued by the USFWS in "A Framework to Assist in Making Endangered species Act Determinations of Effect for Individual or Grouped Actions at the Bull Trout Subpopulation Watershed Scale" (USFS 1998).

Information for determination of the existing conditions for each indicator was based on R1/R4 fisheries habitat surveys, walkthrough habitat surveys, electronic temperature recorders, snorkel and electrofishing fish sampling, and bull trout spawning surveys. Where specific data was lacking or insufficient, the Deerlodge Forest defaulted to a rule-set developed by the Lolo National Forest for determining functional state of each specific indicator. The rule-set uses GIS data and satellite imagery to calculate the number of stream crossings, road densities, percent of streams with roads within a 300 foot buffer, percent of streams without shade, percent of land in a vegetatively regenerated state, percent of private land within the drainage area, and to identify sensitive land-types.

The bull trout subpopulation indicators cannot be addressed at the watershed or sub-watershed scale (6th field hydrologic unit code scale). Therefore, the entire Rock Creek drainage was used to assess the bull trout subpopulation. Habitat indicators were rated at the more appropriate watershed and sub-watershed scale. Sub watersheds include: -01) The headwaters portion of Upper Willow Creek located upstream from it's confluence with McDermott Gulch, -02) That portion of the Upper Willow Creek drainage downstream from McDermott Gulch and upstream of Alder Gulch, -03) That portion of the Upper Willow Creek watershed located downstream of Alder Gulch and upstream of Scotchman Gulch, and -04) Spring Creek and the lower reaches of the mainstream Upper Willow Creek.

A summary of baseline determinations for the Upper Willow Creek are contained in the following table:

Table 3-4

Baseline Conditions of Bull Trout for Upper Willow Creek Drainage

<u>Diagnostic/Pathways:</u> Indicators	Population And Environmental Baseline (list values or criterion and supporting documentation)		
	Functioning Appropriately	Functioning at Risk	Functioning at Unacceptable Risk
<u>Subpopulation Characteristics:</u>	X		
Subpopulation Size			
Growth & Survival		X	
Life History Diversity & Isolation		X	
Persistence & Genetic Integrity		X	
<u>Water Quality:</u>			X
Temperature			X
Sediment			X
Chemical Contaminants/Nutrients			X
<u>Habitat Access:</u>		X	
Physical Barriers			
<u>Habitat Elements:</u>			X
Substrate Embeddedness			X
Large Woody Debris			X
Pool Frequency & Quality			X
Large Pools			X
Off-Channel Habitat		X	
Refugia ²	X		
<u>Channel Conditions. & Dynamics:</u>			X
Wetted Width/Max Depth Ratio			X
Streambank Condition			X
Floodplain Connectivity	X		
<u>Flow Hydrology:</u>		X	
Change In Peak/Base Flows		X	
Drainage Network Increase		X	
<u>Watershed Conditions:</u>		X	
Road Density & Location		X	
Disturbance History		X	
Riparian Conservation Area		X	
Disturbance Regime		X	
<u>Integration Of Species & Habitat Cond.</u>			X

Species Indicators: The following descriptions correspond to the 4 species indicators listed on the FWS Matrix of Diagnostics/Pathways and Indicators for bull trout (USFWS 1998). Each species indicator for the existing condition are described and rated at the subpopulation scale. The entire Rock Creek drainage is considered a single subpopulation, except for the bull trout above the dam on the East Fork. The dam effectively isolates these fish from the rest of Rock Creek.

1) *Subpopulation Size:* There are no reliable population estimates for the entire Rock Creek drainage. However, based on the distribution of adult fish throughout the drainage, and the number and distribution of tributaries that support substantial amount of spawning activity, it is felt that Rock Creek supports a sizable, self-sustaining population of bull trout. This indicator is rated as functioning appropriately for the entire subpopulation.

The Upper Willow Creek watershed (1701020211) does provide some habitat for all life stages of bull trout. However, the watershed contains limited rearing and adult habitat. Low numbers of subadults were captured during surveys of Beaver Creek and the mainstem Upper Willow Creek. While spawning has not been documented in this Upper Willow Creek watershed, high numbers of young of the year were captured during surveys conducted on State Trust Land in Bear Creek during May 2000. Adults from Rock Creek that were radio-tagged for telemetry studies were found to spend substantial amounts of time in the Upper Willow Creek watershed. Subwatershed -03 supports most of the documented use by adults.

2) *Growth & Survival:* Sufficient data has not been collected to determine a trend in population size for bull trout in Rock Creek. Sampling completed in the Hogback section of the mainstem of Rock Creek over the last 15 years indicate that the population may be declining. Redd survey data has been collected on select reaches in several tributaries for up to seven years. However, it is not sufficient to detect any sort of trend. Therefore, this indicator was rated as functioning at risk.

3) *Life History Diversity & Isolation:* The migratory form of bull trout is present in Rock Creek. The adjacent subpopulations include those found in the Blackfoot River and the Upper Clark Fork River. Fish are blocked from upstream migration by Milltown dam, severing connectivity with the rest of the Clark Fork River. The population status of the nearby populations is functioning appropriately in the Blackfoot River and functioning at unacceptable risk in the upper Clark Fork River. Therefore, this indicator was rated as functioning at risk.

4) *Persistence and Genetic Integrity:* Adjacent subpopulations in the Blackfoot and upper Clark Fork Rivers are not functioning appropriately. Their population sizes are depressed, they are persisting in areas of reduced habitat capability, in the presence of competing and hybridizing species, and isolated from downstream populations by Milltown dam. Bull X brook trout hybrids do exist in Rock Creek and brook trout do dominate in a number of the subwatersheds used by bull trout for spawning. This indicator is rated as functioning at risk.

Habitat Pathways: The following descriptions correspond to the 19 habitat indicators listed on the FWS Matrix of Diagnostics/Pathways and Indicators for bull trout (USFWS 1998). Each habitat indicator is described and rated at the appropriate scale - typically at the subwatershed

scale, except for *refugia*, which is evaluated for the entire subpopulation. A combination of qualitative and quantitative data, and local knowledge was used in conjunction with the rule-set developed by the Lolo National Forest to evaluate the following indicators.

Water Quality

1) *Temperature*: Stream temperatures have been monitored for four years at two sites in Upper Willow Creek. One site is located near the upper end of subwatershed -03 and the other is near the lower end of subwatershed -01. Based on this data it appears that summer temperatures commonly exceed 15°C (59°F) in portions of the watershed used as a migratory corridor and exceed 10°C (50°F) in potential spawning habitat for bull trout. This indicator is functioning at unacceptable risk in all four sub-watershed areas.

2) *Sediment*: Measures of fine sediment are based on wolman pebble counts conducted during R1/R4 habitat surveys and visual estimates during walkthrough surveys. The Forest Service relied heavily on the LNF rule-set to assist with the decision in the subwatershed containing substantial amount of private land. Moderate-to-high road densities and valley bottom conversion to pasture lands, below the Forest boundary, in subwatersheds -02, -03 and -04 have likely elevated fine sediment levels. This indicator is; functioning appropriately in subwatershed -01, functioning at risk in subwatershed -02, and functioning at unacceptable risk in subwatershed -03 and -04, and the Upper Willow Creek watershed as a whole.

3) *Chemical Contamination / Nutrients*: Three streams, including Upper Willow Creek (-02, -03, -04), Scotchmans Gulch and Miners Gulch (both in -04) were listed as WQLS on Montana's 1998 303(d) list. All of these waterbodies were determined to lack sufficient credible data to support listing and were removed from the Year 2000 303(d) list. This indicator is functioning appropriately in -01 and functioning at unacceptable risk in the other three subwatersheds and the Upper Willow Creek watershed as a whole.

Habitat Access

4) *Physical Barriers*: Irrigation diversions are located at numerous points, on tributaries and Upper Willow Creek in subwatersheds -02, -03 and -04. At least two of these (on tributaries in -02) block fish passage at all flows. The status of others on private land are unknown. Based on this, the Deerlodge rated this indicator is functioning at risk in all subwatersheds and for the entire Upper Willow Creek drainage.

Habitat Elements

5) *Substrate Embeddedness*: Substrate embeddedness was not measured directly. Levels of fine sediment were used to indicate levels of embeddedness. Measures of fine sediment were based on wolman pebble counts conducted during R1/R4 habitat surveys and qualitatively assessed during walkthrough and fish distribution surveys. The Deerlodge Forest relied heavily on the LNF rule-set to assist with these determinations made for subwatersheds with substantial amount of private land. Moderate-to-high road densities and valley bottom conversion to pasture lands, below the Forest boundary, in -02, -03 and -04 have likely elevated fine sediment levels. This

indicator is functioning appropriately in subwatershed -01, functioning at risk in subwatershed -02, and functioning at unacceptable risk in subwatersheds -03 and -04, and the Upper Willow Creek watershed as a whole.

6) *Large Woody Debris*: Subwatershed -01 is forested and does not contain many streamside roads or stream crossings. The majority of riparian areas are forested, although significant portions consist of sedge/willow meadows. LWD is abundant and recruitment potential is excellent. This indicator is functioning appropriately in this subwatershed. The majority of the riparian zone along the mainstem of Upper Willow Creek in the other three subwatersheds are not forested. Tributary streams are primarily forested, but moderate-to-high road densities and high numbers of crossing structures have likely altered LWD inputs. Therefore, these subwatersheds were rated as functioning at unacceptable risk.

7) *Pool Frequency & Quality*: Determinations of pool frequency and quality were based on R1/R4 habitat surveys in selected reaches located on National Forest lands in subwatershed -01. This analysis was determined to be functioning appropriately. Human activities (conversion of the valley bottom to agricultural uses and road construction) in subwatersheds -02, -03 and -04 have likely reduced the quantity and quality of existing pools. Riparian area conversion to increase forage for livestock has resulted in loss of woody riparian vegetation and streambank stability, increased sediment deposition and reduced pool habitat. Based on these conditions, the other three subwatersheds are functioning at unacceptable risk for this indicator.

8) *Large Pools*: The Forest Service rated this indicator using the results of R1/R4 habitat surveys in the upper subwatershed (-01) as functioning appropriately, and applied the LNF rule-set to the other subwatershed. The other subwatersheds (-02, -03, and -04) were rated as functioning at unacceptable risk.

9) *Off-Channel Habitat*: This indicator was also not measured directly. Instead the Forest Service defaulted to the LNF rule-set, modified by local knowledge. Subwatershed -01 is only slightly impacted by the human activities. Therefore, off-channel habitat was rated as functioning appropriately in this sub-watershed. Conversion of the valley bottom to use as pasture and hay land in the other three subwatersheds has resulted in a much more simplified channel in the rest of Upper Willow Creek, although substantial portions of the streamlength are occupied by beavers. Tributaries are typically higher gradient streams and are generally less impacted by human activities. All three subwatersheds have moderate road densities, but all have a relatively high percentage of roads within the Riparian Habitat Conservation Area. This indicator was rated as functioning at risk in subwatersheds -02, -03, and -04 due to the amount of riparian area conversion and the quantity of roads and crossings.

10) *Refugia*: This indicator is rated for the entire Rock Creek subpopulation. Several portions of the sub-basin are designated Wilderness, or managed as roadless. These areas are for the most part well distributed across the sub-basin and are connected. A notable exception is the East Fork, which is isolated from the rest of Rock Creek by a dam. Refugia exist in Welcome Creek, Ranch Creek, Alder Gulch, Stony Creek, the Ross Fork and Middle Fork. This indicator is functioning appropriately.

Channel Condition and Dynamics

11) *Wetted Width/Max Depth Ratio*: Wetted width/maximum depth ratio values are based on R1/R4 habitat surveys completed in sub-watershed -01 and the LNF rule-set. The determination for the other three sub-watersheds is based on the sediment determination made using the LNF rule-set. Therefore, wetted width/maximum depth ratio was rated as functioning appropriately in subwatershed -01 and the others are functioning at unacceptable risk.

12) *Streambank Condition*: Streambank stability is based on R1/R4 and walkthrough habitat surveys on portions of most perennial streams on National Forest lands. The LNF rule-set was also used as the majority of Upper Willow Creek lies on private land. Forest Service habitat survey data indicate streambank stability has been impacted by grazing and mining in portions of subwatershed -01. Therefore, this indicator was rated as functioning at risk in -01. For the other three subwatersheds the rule-set, modified by limited habitat survey data was used to determine a functioning at risk rating for subwatershed -02 and a functioning at unacceptable risk rating for both subwatershed -03 and -04.

13) *Floodplain Connectivity*: Human activities (roads, conversion of valley bottom lands to agricultural uses and irrigation practices) have reduced floodplain connectivity in the three lower subwatersheds. Although high water during spring runoff typically overtops streambanks and access the floodplain in much of the watershed, the extent of floodplain access has probably been reduced. However, some function still exists. This indicator is rated functioning at risk for subwatersheds -01, -02 and -03. Floodplain access is largely unaltered in -01 and functioning appropriately in this sub-watershed.

Flow/Hydrology

14) *Change in Peak/Base Flows*: The timing and magnitude of peak and summer low flows are altered in -02, -03, and -04 due to the presence of numerous irrigation diversions. Only two subwatersheds have received sufficient timber harvest to possibly affect transpiration rates, -03 and -04. This indicator is functioning at risk in subwatersheds -02, -03, and -04 and functioning appropriately in subwatersheds -01.

15) *Drainage network Increase*: Subwatershed -01 has few roads and no irrigation ditch system. This subwatershed is functioning appropriately. Higher road densities (0.6-1.6 miles/mile²) and extensive irrigation ditch systems in subwatersheds -02, -03, and -04 have increased the drainage network to some degree. This indicator is functioning at risk in these subwatersheds.

Watershed Conditions

16) *Road Density & Location*: Subwatershed -01 has few roads and stream crossings. This indicator is functioning appropriately. The other three subwatersheds have higher road densities, varying from 0.6 miles/mile² in -02 to 1.6 miles/mile² in -04. All three of these subwatersheds contain numerous (22-37) stream crossings. This indicator is functioning at risk in these Habitat Unit Conservations.

17) *Disturbance History*: Upper Willow Creek contains substantial amounts of sensitive soil types, primarily granitics in subwatersheds -02 and -03. The greatest acreage of timber harvest in

the watershed has occurred on these soils in subwatershed -03. Road density, the number of stream crossings and proximity of roads to streams are also influencing this indicator in this subwatershed. This indicator is functioning at unacceptable risk in subwatershed -03. Subwatershed -01 has had relatively little timber harvest, contains no irrigation diversions and has a low road density. This indicator is functioning appropriately. One-third of subwatershed -02 is comprised of sensitive soils. Road density on these soils are low (0.7 miles/mile²). The flow regime is altered in subwatershed -02 as a result of an extensive irrigation diversion system. This subwatershed is functioning at risk. Most of subwatershed -04 is private land. No areas of sensitive soils are known, although the road density is moderate and 30% of these roads are within 300' of streamcourses. The flow regime has been altered by the presence of an extensive irrigation ditch system. Based on these factors subwatershed -04 was rated as functioning at risk for this indicator.

18) *Riparian Conservation Area*: Substantial disturbance (roads, agricultural practices, livestock production, irrigation diversion) has occurred within Riparian Habitat Conservation Areas in subwatersheds -03 and -04. These subwatersheds are functioning at unacceptable risk. Subwatershed -01 is mostly unimpacted by human activities (functioning appropriately). Subwatershed -02 still retains a moderate similarity to natural riparian conditions, although the downstream portions of Upper Willow Creek in this subwatershed are more altered. This subwatershed is functioning at risk.

19) *Disturbance Regime*: The Upper Willow Creek watershed has been significantly altered by human activities for nearly 100 years. Evidence of human activity is minimal in subwatershed -01, but increases moving downstream. The Sub-basin Review (USFS, 1998) identified the forest types in the downstream subwatersheds as "high risk" for forest species/composition and insect/disease due to a higher percentage of warm/dry habitats. Subwatershed -03 may be the highest risk subwatershed due to the amount of sensitive soils, past human activities and the vegetation risk. Subwatershed -02 also contains a substantial percentage of sensitive soils but has had less human impacts, while subwatershed -04 has had the most extensive level of human use but lies on stable land forms. The ratings for the subwatersheds are functioning appropriately in -01 and functioning at risk in -02, -03, and -04.

Integration of Species and Habitat Conditions

Bull trout in the Upper Willow Creek watershed exist as only a remnant population. Eastern brook trout are abundant and hybridization between these two species is documented in this watershed. Westslope cutthroat trout are common in the upper portion of the watershed. Their status is unknown in the lower reaches of Upper Willow Creek, although a genetically pure population has been documented in a tributary (Cowan Gulch). Both rainbow and brown trout have been documented in the lower reaches of Upper Willow Creek. Fish sampled in the lower reaches of the stream have tested positive for whirling disease and *T. tubefix* worms have been sampled at a number of locations throughout the watershed.

Upper Willow Creek has been impacted by human activities for nearly a century. Past human activities, primarily mining, roading, water diversions, the introduction of non-native fish, and conversion of land to agricultural purposes has severely reduced the capability of this watershed

to support the full compliment of life forms of native fish. These activities have altered the composition and extent of the riparian zone along the creek and resulted in impaired function of the stream channel and have reduced habitat quality for native salmonids. The numerous, small side drainages have all been impacted by a variety of human activities. Instream habitat conditions are impaired and connectivity has been reduced. Water quality emanating from these streams is also reduced. No portions of the watershed are capable of functioning as refugia due to the legacy of human settlement.

Only subwatershed -01 is relatively unimpacted by human activities. Even this subwatershed, located in the headwaters of Upper Willow Creek is dominated by exotic species. Most habitat indicators are functioning appropriately, but large pools are lacking, access is impeded by downstream irrigation diversions and water temperatures are too high. This subwatershed is functioning at risk. A preponderance of non-functional calls for the habitat indicators, in addition to the dominance of exotic fish species in the other subwatersheds, combine to the integrated call functioning at unacceptable risk in -02, -03 and -04. The Upper Willow Creek watershed as a whole is functioning at unacceptable risk due to these conditions.

Westslope Cutthroat Trout

Westslope cutthroat trout (WCT) are recognized as a Class A species by the State of Montana. Class A species are defined as having limited numbers and/or limited habitats both in Montana and elsewhere in North America; elimination from Montana would be a significant loss to the gene pool of the species or subspecies. DNRC has entered into a Statewide conservation agreement for westslope cutthroat trout. A Memorandum of Understanding (MOU) and Conservation Agreement for Westslope Cutthroat Trout in Montana was finalized by FW&P and signed by DNRC and other cooperators in May of 1999. This agreement was a collaborative effort developed by the Westslope Cutthroat Steering Committee that is represented by numerous state and federal resource agencies, conservation and industry organizations, sportsmen and private landowners. Under the MOU, DNRC has agreed to protect all genetically pure and slightly introgressed (less than 10% introgressed) WCT populations. Protection includes maintaining or developing high quality habitat to prevent extirpation.

Wildlife

Issue 1: Overstory cover and movement corridors

The project area currently provides a high degree of canopy cover and connectivity to adjacent larger blocks of U.S. Forest Service land. The western block of Forest Service land has a widely dispersed road system and scattered harvest units. Between each harvest unit are relatively large parcels of dense timber. East of Upper Willow Creek the school trust land in Section 16 received harvest treatment in the mid 80's. Forest Service and BLM land form a 12-mile long by approximately 2-mile wide block of timber, which has only occasional low standard roads and virtually no timber harvesting. Southeast of the project area is open grassland habitat. The Upper Willow Creek riparian areas provide short overstory cover of deciduous vegetation, so that

it is unavailable as overstory cover in winter. In summer it forms a long contiguous strip of low elevation riparian bottomland, ranging from $\frac{1}{4}$ to $\frac{3}{4}$ miles wide. Contiguous with Upper Willow Creek is upland coniferous forest located in the project area. To the east of Sections 5, 8, and 17, much of the coniferous cover adjacent to Upper Willow Creek has been fragmented with past harvest. The exception is near the headwaters of Upper Willow Creek, in the northeast portion of the elk security analysis area.

Issue 2: Snags and coarse woody debris

The project area has scattered large-sized Douglas fir and some large ponderosa pine with defects that would make suitable snag recruitment trees. Most of the project area is lodgepole pine. Approximately 189.6 acres of timber within the project area meet Greene et al. old growth criteria. These stands tend to contain a higher percentage of dead and dying lodgepole, and include areas with many snags and snag recruits. These stands are scattered through the west parcel, and dominate the north half of Section 5. This type of habitat is often used by the black-backed woodpecker. The entire State ownership in Upper Willow Creek contains 115 acres of snag-poor habitat all in Section 16 that was harvested using clearcuts in the mid 80's.

Issue 3: The proposed road building and timber harvesting could have a negative impact on the elk population that uses this area, by reducing security cover.

Dense lodgepole pine stands that dominate the drainage provide both hiding and security cover for elk herds that use the area. The upper third of the Upper Willow Creek drainage is used by elk for summer and fall range. With assistance from Dan Hook (MT Department of Fish, Wildlife, & Parks), the analysis area required to address hiding and security cover issues was delineated (Fig. 3-1). The area delineated includes annual home range for the local elk herd. For the remainder of this document, this delineated area will be referred to as the Elk Analysis Area (EAA). East of Upper Willow Creek, there has been almost no timber harvesting or road construction. Existing roads are mostly two-tracks and used for livestock and ranch management. Out of this approximately 45.5 mi² EAA, the DNRC is proposing to harvest between 804 and 1,315 acres through a variety of harvests designed to approximate various fire intensities.

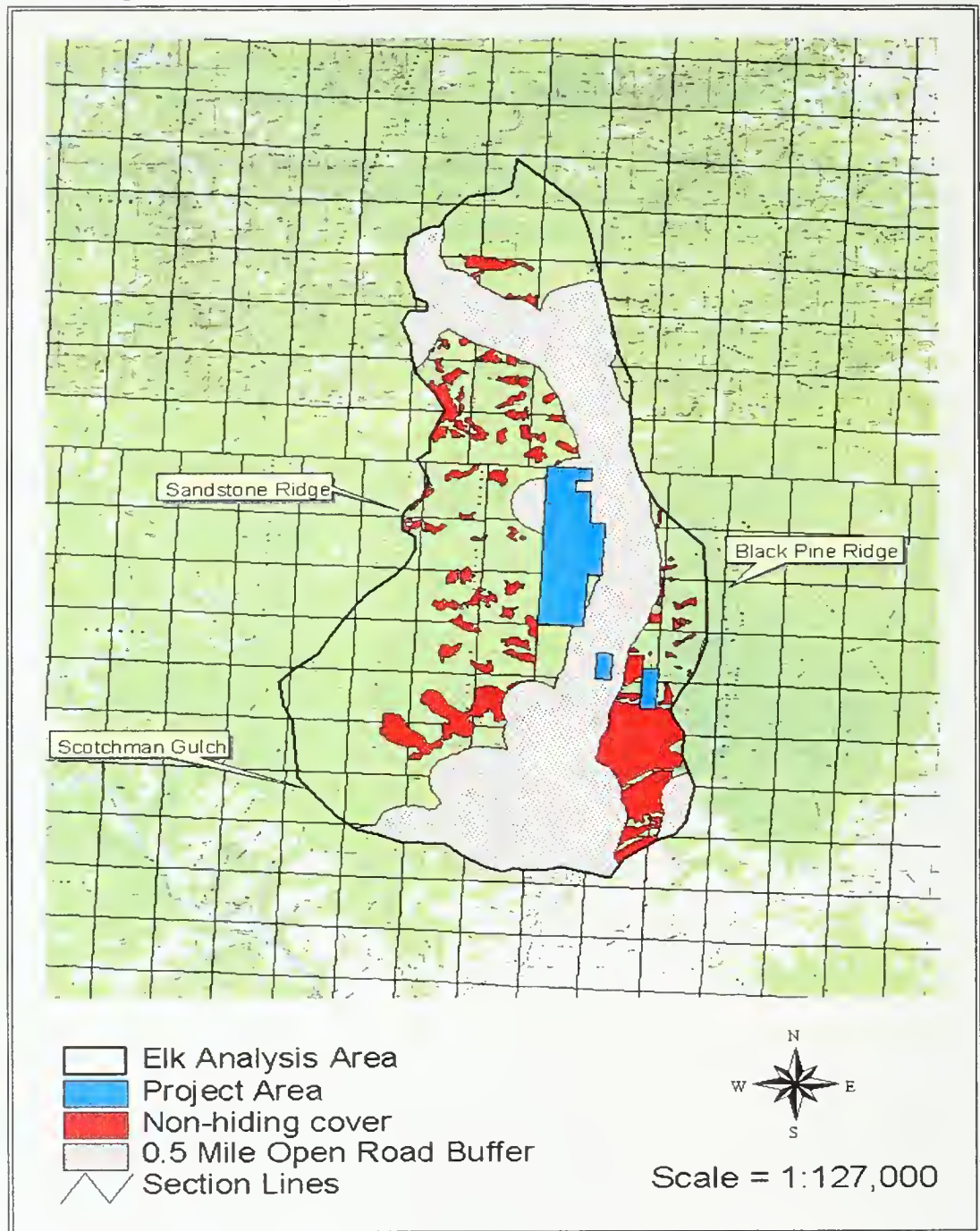
Upper Willow Creek flows south for approximately 18 miles through forested land, hay fields, and pasture before joining Rock Creek at Gilles Bridge. The valley formed by Upper Willow Creek is relatively narrow with steep mountains flanking it on the east, and more gentle mountains on the west and north sides. The south end of the drainage is dominated by high-energy exposures that are predominately grassland interspersed with Douglas fir and lodgepole pine on north aspects. Some smaller patches of grassland are included on southerly aspects and near the creek bottom. The upper 1/3 of the drainage is composed of dense stands of lodgepole pine with some Douglas fir on south aspects. Spruce and subalpine fir dominates higher elevation creek bottoms and other moist sites.

The EAA is bounded by Scotchman's Gulch on the south, the Black Pine Ridge Mountains on the east, Sandstone Ridge on the west, and a ridge between Harvey Creek and Upper Willow

Creek on the north (Fig. 3-1). The EAA covers approximately 29,119 acres. Of the total acreage within the EAA, approximately 3,911 acres have either been previously harvested or are grassland. Additionally, approximately 14,564 acres of the EAA occur within 0.5 miles of open roads during the hunting season. There are approximately 10,644 acres of elk security habitat (or 36.6% of the area) within the EAA currently, as defined by Hillis et al. (1991).

The project area for this analysis is defined as those 1,811 acres of DNRC-owned parcels in which timber harvesting or road construction are proposed. Of these acres, there are approximately 1,066 acres (58.9% of the area) in elk security habitat within the project area. (See figure 3-1)

Figure 3-1. Elk Analysis Area for the proposed Phoenix timber sale



Issue 4: Habitat that is important to moose may be degraded by the proposed action.

Analysis of this moose issue will utilize the project and analysis areas previously described for elk. Moose are the largest ungulate in North America, distributed throughout Alaska, Canada, and many of the border states. In general, moose habitat includes: areas of abundant high-quality winter browse; shelter areas that allow access to food; isolated sites for calving; aquatic feeding areas, young forest stands with deciduous shrubs and forbs for summer feeding; mature forest that provides shelter from snow or heat; and mineral licks (Thompson and Stewart 1998). As such, much of the Upper Willow Creek drainage bottom is considered moose winter range habitat by the Montana Department of Fish, Wildlife & Parks, and the surrounding uplands receive overall use by moose. The project area is immediately adjacent to, and the analysis area contains, the Upper Willow Creek bottom, which contains several shrub species that moose forage upon. Additionally, along the border between Sections 5 and 8, T8N, R15W, within the project area, there are 7 potholes ranging in area from 0.43 to 1.7 acres, and totaling 6.28 acres. Within the 1,786-acre project area, there are 212 acres that receive overall use by moose, and 1,599 acres of moose winter range. Currently there are no regenerating clearcuts within the project area forested habitat. Within the 29,119-acre analysis area, approximately 24,093 acres receive overall use by moose and 13,383 acres are considered to be moose winter range habitat. Currently, there are approximately 3,150 acres of regenerating clearcuts within the analysis area, for a total of 10.8% of the total analysis area.

Both the project and analysis areas are located within moose hunting district 210, which issued 4 bull and 4 cow permits, respectively, to harvest moose in 2002. Rempel et al. (1997) evaluated the effects of different landscape management strategies designed to benefit moose populations in Ontario and speculated that the greatest hindrance to increasing moose populations was increases in hunter access resulting from roads required to implement the habitat management strategies. Thus, increasing hunters' road access might degrade moose habitat quality due to increased hunting vulnerability. Currently there are 0.04 miles of open road and 3.8 miles of gated/locked roads within the project area, and 57.8 miles and 40.2 miles, respectively, within the analysis area. Areas behind locked gates are accessible for walk-in hunting opportunities.

Issue 5: Threatened, endangered and sensitive animal species.

In Chapter 1 several animal species, which are classified as threatened, endangered or sensitive, were identified and further analysis eliminated because of habitat requirements. The lynx, grizzly bear, gray wolf, black-backed woodpecker, and flammulated and boreal owls are species of special concern that may occur within the project area.

Lynx

The analysis area for lynx consists of a one-mile radius area surrounding and including the project area. Lynx could occur within the project area. Lynx prefer extensive areas of remote habitat. The analysis area is surrounded by nearly 90,000 acres of essentially unroaded coniferous forest. Potential lynx denning habitat consists of relatively dense stands (at least 50% canopy closure) of mature forest structure at 5,000 feet elevation or higher, in spruce-fir habitats, which contain numerous downed logs or root wads. Most stands on the west side of the project

area are cool and moist types preferred for lynx denning habitat, although they are lodgepole pine and not fir-dominated. Foraging habitat includes young dense lodgepole pine stands, and mature forest stands with a well-developed shrub and seedling/sapling layer that support snowshoe hares. No lodgepole stands in the project area are younger than 40 years old. However, there are approximately 391 acres of mature forest within the project area that may serve as foraging habitat. Lynx prefer habitat without plowed roads or snowmobile trails in winter. The large footpad of a lynx allows the cat to use areas with deep snow that other carnivores are unable to exploit (e.g., bobcat and coyote).

Grizzly Bear

Grizzly bear are the largest terrestrial predators in North America, feasting upon deer, rodents, fish, roots and berries, as well as a wide assortment of vegetation (Hewitt and Robbins 1996). Depending upon climate, abundance of food, and cover distribution, home ranges for male grizzly bears in northwest Montana can range from 60 - 500 mi² (Waller and Mace 1997). The search for food drives grizzly bear movement, with bears moving from low elevations in spring to higher elevations in fall, as fruits ripen throughout the year. Bears are also very opportunistic feeders and will scavenge on human-provided foods, including garbage, bird seed, and pet food. The project area is approximately 39 miles south of the grizzly bear recovery area in the Northern Continental Divide Ecosystem. However, in 2002, grizzly bears expanded their range to occupy habitats within the Garnet Mountain Range, and south towards Drummond, Montana. Although unconfirmed, a grizzly bear may be located in the vicinity (J. Jonkel, MT FWP, pers. comm., November 2002).

The grizzly bear analysis area follows Rock Creek north to the Clark Fork River, east to Flint Creek, and then south to Eagle Canyon and Rock Creek, totaling 663 mi². Table 3-5 depicts land ownership patterns within the grizzly bear analysis area. Using the DNRC GIS road layer, which contains forest roads, highways, and some private roads, and the Beaverhead/Deerlodge National Forest Travel Map, open road density within the grizzly bear analysis area was calculated as being at least 1.66 miles/mi², with total road density being at least 1.93 miles/mi² (simple linear calculation). Within the project area, open road density was calculated as being at least 0.0 miles/mi², and total road density at least 1.1 miles/mi² (simple linear calculation).

Table 3-5
Land ownership within the grizzly bear analysis area

Land Owner	Acres
U. S. Forest Service	204,377
Private lands	181,247
Plum Creek Timber Company	14,276
U. S. Bureau of Land Management	14,056
DNRC	10,072
Waterways	187
MT Fish, Wildlife, and Parks	20
Total	424,235

Gray Wolf

Wolves are currently classified as endangered in Montana under the Endangered Species Act. Due to the large territories of wolf packs (U.S. Fish and Wildlife Service 2002), the analysis area described for elk and moose will also be used for this analysis. The nearest known wolf packs are the Bighole pack 40 miles distant on the Montana/Idaho border, bands of wolves in the Helmville and Potomac areas and the Willow Pack 7 miles to the northeast. No wolf den sites are currently known to exist within the project or analysis areas. Cover and road densities likely have some influence on wolf security; however, prey densities and availability also influence wolf success. Fluctuations in deer and elk densities over time will likely have an effect on the presence or absence of wolves within the project and analysis areas.

Black-backed Woodpecker

The analysis area for black-backed woodpeckers consists of a one-mile radius area surrounding and including the project area. Black-backed woodpeckers are associated with burned or bug infested mature forests. In particular, Sections 5, 8, and 17 may provide black-backed woodpecker habitat. Although no recent stand-replacement burns have occurred, insect populations are present, albeit, below infestation levels. Given the large area of potential available habitat within the project area (1,786 acres), plus adjacent stands of suitable habitat, it is likely that this area supports resident black-backed woodpeckers. The Montana Natural Heritage Program lists black-backed woodpecker as occurring within the Alder Gulch Quadrangle in 1998.

Flammulated Owl

Flammulated owls occur in mature ponderosa pine and mixed pine Douglas fir stands. Nesting in cavities, flammulated owls prefer those cavities excavated by pileated woodpeckers and common flickers, where available. Nest trees in two Oregon studies were 22 to 28 inches dbh (McCallum 1994). Habitats used have open to moderate canopy closure (30-50%) with at least two canopy layers, and often are adjacent to small clearings. Additionally, stands used often have a shrub understory. An open forest structure with shrubs contributes to producing flammulated owl prey, insects. The most likely areas for flammulated owls occur within approximately 331 acres dispersed throughout Sections 8, 17, 21, and 28 of the project area. The Montana Natural Heritage Program lists the flammulated owl as occurring within this ¼ latilong (#26-C) in 1995. Because the flammulated owl has a home range <50 acres in area (McCallum 1994), the analysis area for this species will be the project area.

Boreal Owl

Preferred boreal owl habitat includes spruce and fir stands from 5,000 to 8,000 feet in elevation. Currently, subalpine fir is present within, but does not dominate, stands in the project area. Elevations are suitable for boreal owls, ranging from 5,460 to 7,940 feet. When multistoried forest is not available, boreal owls can occasionally be located in lodgepole pine stands when they possess trees ≥ 15 inches dbh, and trees > 9 inches dbh that average 105 trees per acre (Hayward et al. 1993). Although approximately 1,362 acres of boreal owl preferred habitat types occur within Sections 5, 8, 17, and 21, approximately 175 acres would currently be suitable for boreal owls due to structural development. Of these acres, 137 acres occur in Section 5, 28 acres in Section 17, and 10 acres in Section 21. The Montana Natural Heritage Program lists this

species as occurring within the ¼ latilong (#26-C) in 1991. Because boreal owls have a small home range, the analysis area for this species will be the project area.

Northern Goshawks

Northern goshawks are associated with mid- to late-successional forests, with snags and downed logs providing habitat for prey. Goshawks forage in a variety of forest structural stages, including openings. The project area contains >1,800 acres of potential foraging, and some nesting, habitat for goshawks. Likely nesting areas include stands on the lower portions of north-facing slopes in the stem exclusion or understory reinitiation stages of stand development (Oliver and Larson 1996, McGrath et al. 2003). Potential nesting areas could be located within Sections 5, 8, 21, and 28.

Soils

1.) Geology & terrain

The sale area is located on moderate slopes with glacial outwash and residual soils weathered from sandstone and argillites. Tertiary valley deposits of silty clay loam texture occur in the swales, draw bottoms and footslopes. Granitic bedrock occurs on the East side of the valley and south of the proposed harvest areas. Several pothole ponds and wet areas occur on the glacial outwash deposits.

There are no especially unusual or unique geologic features in the sale area. Slopes are generally stable. One area of marginal slope stability occurs in SW 1/4 Section 8 and is a concern for road location and construction, but is not part of any proposed action. Past irrigation ditch failures have caused some slope instability and washouts. Roads and cutting units were located and field reviewed to avoid unstable areas.

Rock outcrops are rare and generally fractured bedrock, where encountered at shallow depth, is common excavation or rippable, and should not limit road construction. One area of well-fractured argillite on a ridge in Section 17 is a good potential source to develop for pit-run and was reviewed for location of an approximate 1 acre borrow source.

Soil survey data from the Deer Lodge N. F. and Soil Conservation Service were analyzed and the project area field reviewed to verify soil types. Midslopes and ridges have mainly Worock, and Winkler series sandy loam topsoils over gravelly sandy loam and cobbly clay loam subsoils, which are well drained and droughty. Main soil concern is potential displacement. These soils have a long season of use and are well suited to tractor operations. Erosivity is moderate to low and material quality is good for road construction.

Dominant soils on the forested sites in the project area on the west side of the valley are Garlet and Loberg gravelly loams on moderate slopes of 15-35%. These soils are mainly well drained on convex slopes and include some somewhat poorly drained areas in draws. Garlet soils are very gravelly sandy loams. Loberg soils have shallow gravelly loam topsoils over finer textured gravelly clay loam subsoils. Main soil concerns are potential rutting, compaction and

displacement. Erosivity is moderate and can be controlled with standard drainage features. Clay rich soils of low bearing strength which occur at shallow depth along portions of the main access roads can be impassable when wet if not graveled. These soils have a limited dry season of use and tend to remain moist till July.

Dominant soils in the project area on the east side of the valley are Bignell gravelly clay loams with lesser areas of Worock gravelly loams on moderate slopes of 15-35%. These soils are mainly well drained on convex slopes and include somewhat poorly drained areas in draws. Worock soils have shallow topsoils over deep cobbly clay loams forming in tertiary deposits and volcanics. Bignell soils have deep gravelly clay loam topsoils over finer textured gravelly clay loam subsoils. Main soil concerns are potential rutting, compaction and displacement. Erosivity is moderate and can be controlled with standard drainage features. Clay rich soils of low bearing strength which occur at shallow depth along portions of the main access roads can be impassable when wet if not graveled. These soils have a longer dry season of use and tend to dry out earlier in the year than the west side of the valley.

Small riparian potholes occur in the area and will be avoided. Swales on the toeslopes include areas of somewhat poorly drained soils that support wet-site vegetation (bluejoint reedgrass) indicative of a seasonally high watertable. There is an existing segment of irrigation ditch in the SE ¼ of Section 8 that is deeply eroded and downcut, and the largest source of sediment within the project area (refer to hydrology report).

Cumulative Effects

Most of the project area has not been previously harvested and so no existing cumulative effects were noted. There are several small areas (estimated 26 acres) that were thinned and brush stacked by hand labor and hauled out with ATV's and pickups. The post and rail operations resulted in minor effects to soils and few trails are evident.

Economics

Because of the proposed sales location it is reasonable to assume that sawmills from Townsend, Hall, Seeley Lake, Deer Lodge and Missoula would compete for the offered raw materials. While Granite County is known for its ranching and cattle production, there is a long history of the local logging industry providing raw materials for mining and lumber production.

Total timber harvest from Montana forests has declined since the 1987 harvest of 1,400,000 MBF, to 854,000 MBF in 1999. This represents a 40% reduction in annual harvest which has resulted in a corresponding reduction in milling capacity.

The following table provides some general demographic information pertinent to Granite, Powell and Deer Lodge Counties.

Table 3-6
General Demographic Information

Demographic	Granite Co.	Powell Co.	Deer Lodge Co.
Population 2000	2830	7180	9417
Average Household Size	2.33	2.39	2.26
High School Enrollment	164	314	476
Grade School Enrollment	288	691	927
Source: Montana Departments of Labor and Commerce and the Office of Public Instruction			

DNRC does not track costs for individual projects. An annual cash-flow analysis is conducted on the DNRC forest product sales program. Revenue and costs are calculated by land office and Statewide. Revenue-to-cost ratios are a measure of economic efficiency. A ratio value less than 1.0 means costs are higher than revenues (no trust contribution). A ratio greater than 1.0 means revenues are higher than the cost (a positive trust contribution). A ratio equaling 1.0 means that the costs equal the revenues. Revenue to cost ratio for Southwest Land Office and the Department as a whole are presented in the following table.

Table 3-7
Annual Rate of Return

Year	Southwest Land Office	Statewide
1995	1.24:1	2.07:1
1996	2.30:1	1.68:1
1997	2.08:1	1.89:1
1998	1.83:1	1.72:1
1999	1.44:1	1.36:1
2000	2.36:1	2.78:1
2001	2.69:1	1.62:1
2002	2.57:1	1.75:1
2003	1.61:1	1.75:1

Total revenue is revenue from timber sales, permits, Forest Improvement and road maintenance. Total cost is the sum of timber operating and general administration.

Table 3-8
Covered Wages and Employment

Covered wages and employment during 2003 by County						
County	2000 Population	CLF	Employed	Un-employed	Rate	Year ago rate
Deer Lodge	9417	3730	3488	242	6.5%	6.1%
Granite	2830	1021	956	65	6.4%	6.0%
Powell	7180	2153	2061	92	4.3%	6.7%

Table 3-9
2001 Average Hourly Earnings

2001 Average Hourly Earnings for Private Nonagricultural Production Workers (Statewide)		
Lumber and Wood Products	\$14.81	12 Month Average
Mining (Non Metallic)	\$18.11	12 Month Average
Accountants & Auditors	\$18.72	12 Month Average
Tax Preparers	\$13.07	12 Month Average
Medical & Public Health Social Workers	\$15.82	12 Month Average
Restaurant Cooks	\$8.19	12 Month Average
Construction (Gen build)	\$15.35	12 Month Average
Manufacturing	\$14.68	12 Month Average
Transportation	\$14.17	12 Month Average
Trade	\$9.68	12 Month Average

Source: Montana Department of Labor and Industry, Research and Analysis Bureau

The data in Table 3-8 indicates that both Deer Lodge and Granite Counties have had an increase in unemployment while Powell County had a net decrease. Employment data by county and major employer were not available for either Granite or Powell Counties from the Department of Labor and Industry. Both counties support a sawmill along with the associated logging industry. Granite County, where the sale is proposed, supports a mill which produces approximately 15 MMBF of lumber. There is also a mill in Powell County which is substantially larger, 143 MMBF of lumber production, but somewhat less stable. The current owners put the mill up for sale approximately one year ago. While they have an offer from a local party the sale has not been completed yet. In addition to the sawmills and logging community there are several smaller custom sawmills and two active post and pole operations located in Granite County.

Table 3-9 provides a general comparison of average wages, on a statewide basis, for various industries of the six major areas described, lumber and wood products ranks third.

Visual

Upper Willow Creek is a relatively narrow valley, which combines wide-open grassland, dense lodgepole pine forests and on south facing slopes occasional stands of Douglas fir and ponderosa pine. Upper Willow Creek flows from north to south joining Rock Creek at Gillis Bridge. Here the valley is dominated by grassland with occasional Douglas fir and lodgepole pine located in side draws and on more northerly exposures. Approximately 2 miles up stream, Spring Creek joins Upper Willow Creek. Grassland continues to dominate the east side of the drainage while of timber increases along the west side.

Most early logging within the drainage occurred between Scotchman and Miners Gulch. Much of this early logging has regenerated and is visible from the county road, which closely follows Upper Willow Creek. The west side of the valley is dominated by hay fields and ranch houses.

Continuing further to the west timber, mainly Douglas fir and lodgepole pine, dominate north-facing slopes while ridge tops and higher energy aspect are predominately grassland with scattered patches of Douglas fir and ponderosa pine. On the east side, grasslands continue to dominate with occasional patches of lodgepole and Douglas fir in the draws until you reach Arbuckle Gulch where grassland gives way to stands of lodgepole pine. These stands descend to the county road and provide travelers a sense of driving through the middle of a forest. Eighty acres of 70-90 year old and old growth, mistletoe infested, lodgepole pine on School Trust Lands are located immediately north of Arbuckle Gulch, in the W1/2 SW1/4 Section 21, T8N, R15W. Pre-commercial thinning was done on approximately 10 acres of this ground in the past and is very visible from the county road. A narrow strip of privately owned timber provides a screen between the county road and the remainder of the 80 acres.

Approximately 100 acres of timber is part of the proposed project area and is located in the SE1/4SE1/4 Section 21 and the E1/2NE1/4 Section 28, T8N, R15W. This timber is only visible at a limited number of locations along the county road in the Swanson Gulch area, because of its distance from the road and adjacent topography.

Private lands adjacent to State ownership in Sections 21 and 28 were harvested approximately 15 years ago. Un-merchantable material was left standing and there has been good success in regeneration creating a two-storied stand.

Harvesting completed by the U.S.F.S., within the last 15 years, is very visible in the upper reaches of the drainage. A majority of these units are clearcuts, 40 acres in size, or smaller with irregular boundaries. These units stand out in contrast to second growth and mature stands. The BLM harvesting lower down in the drainage is relatively old, having been completed in the mid 1970's, compared to USFS harvest units. The BLM cutting has had moderate success in regenerating and patches of 6' to 10' tall lodgepole pine and Douglas fir, are visible from the Upper Willow Creek county road. Some mature timber was left as a seed source creating a multi storied stand in sharp contrast to the surrounding older stands.

From the county road looking west trust lands appear as a natural stand of second growth lodgepole pine with occasional patches of mature lodgepole pine present. In the draw bottoms the lodgepole pine trees are mixed with species such as subalpine fir and Engelmann spruce. Some of the south facing slopes have a more open park-like appearance due to aspect and drier conditions. Subalpine fir and Engelmann spruce are absent from the south facing slopes where large mature Douglas fir and ponderosa pine are growing along with an understory of lodgepole pine.

Vegetation

Forest Health

The existing stands of timber in the project area are dominated by lodgepole pine. Large-scale stand-replacing fires and low intensity ground fires, play a major role in the ecology of Lodgepole Pine forests (Fischer and Bradley, 1987). When stands of lodgepole pine become

older than 60-80 years, natural thinning processes such as fire, insects and disease, cause mortality and fuel buildup to begin. Over time fuel loading becomes heavy enough that any fire ignition will lead to a stand replacement fire that may cover large expanses of land. Increment bore sampling and conversations with long-time local residents indicate that a large stand replacement fire occurred in this drainage between 1920 and 1930. Mature lodgepole pine, which are present on site show signs of fire scarring from frequent low intensity ground fires. Most dominant trees have these scars on the up-hill side indicating that at some point they have been exposed to light ground fires. When these fires occurred the trees were large enough and fuels light enough to prevent the ground fire from killing them.

The project area is dominated by two distinctly different habitat types: Douglas Fir/Dwarf Huckleberry and Alpine Fir/Dwarf Huckleberry. Fisher and Bradley (1987) place both of these in fire group seven. Group 7 are those habitat types which are cool and usually dominated by lodgepole pine. In describing the role fire plays in this group they estimated that severe, stand replacing, fire occurs on a 100 to 500 year basis below 7500 ft. in elevation. Above this elevation the time period between stand replacing fires is longer. Low intensity fires occur on a 50 year cycle (Fischer and Bradley (1987).

Work on the Beaverhead Forest by USFS personnel Diane Hutton and Brian Quinn, indicates that on average, high elevation lodgepole pine timber types will receive 4-5 low intensity ground fires during their life if there is no fire suppression (Diane Hutton pers. comm.). Lack of fire in these stands, due to fire suppression, appears to be having significant effects on stocking levels, fuel buildup, plant succession, historic age class distribution and nutrient cycling. This is especially evident in Section 5 where a large portion of the section has a much higher downed woody component than the remainder of the stands within the State's ownership. Within this same stand an understory of subalpine fir has become well established indicating that climax tree species will soon be a co-dominate. Present mature lodgepole pines are decadent and are dying rapidly. These stands have a buildup of downed woody material and a substantial amount of ladder fuels present. It appears to be at risk for a stand replacement type of fire.

In Upper Willow Creek, forests appear to fall into two general types: Douglas fir generally grows in stands that produce multiple aged classes. Small patches of trees are killed by insects or diseases, which create openings and then, over time, regenerate creating a multistoried forest. Fire has historically played an important role in the development of the Douglas fir type in this area. Over a 150-300 year period, stands may end up consisting of 3 or 4 different age classes of trees.

Tree species such as lodgepole pine regenerate under conditions where there is abundant sunlight and bare mineral soil. Natural disturbances in lodgepole pine tend to follow patterns, which leave large areas of timber roughly the same age that became established after a major fire. Between 30 and 100 years of age, trees will often be subjected to frequent, low intensity ground fires, which act as a thinning agent. As stands become older, forest pathogens play a more active role, killing larger portions of the forest and increasing fuel loading. Forest succession also progresses creating an understory of more shade tolerant trees such as subalpine fir or Douglas fir. Eventually a large stand replacement fire will occur and a new stand will again become

established. A combination of harvest types is being proposed to simulate this natural cycle. Most stands in the project area have higher stocking rates and greater canopy closure than occurred historically. The following table provides a visualization of the impacts that 90 years of fire suppression have created. Information in the historic levels column was calculated by multiplying the historic age class percentage times the total number of Lodgepole pine acres within the project area.

Table 3-10
Historic Age Class Distribution and Current for Upper Willow Creek
within the project area, expressed in acres

Age Class	Historical Levels Ac.	Existing Condition Ac.
Non-stocked	152	0
1-40	575.4	0
41-100	727.5	1,300.7
101-Old Stand	169.2	201.5
Old Stand	67.7	189.6
TOTAL	1,691.8	1,691.8

Old growth species habitat

Even though this project area is within the Beaverhead/Deerlodge National Forest, it was felt that the western Montana Zone, old growth type code 7, (Greene et al. 1992) was most applicable because the stands are well west of the continental divide and meet the vegetative characteristics described under this code. Stand attributes that old growth dependant species commonly use are:

- ◆ Large sized trees
- ◆ Standing dead and downed woody material
- ◆ High percentage of rot and disease
- ◆ High potential for insect infestation
- ◆ Other tree deformities
- ◆ Multi-storied structure

The west side of the proposal area contains a relatively large (137 acre) block of old growth that is located in the North ½ of Section 5, and one smaller stand 28 acres in Section 17. Individual old growth Douglas fir and Ponderosa Pine trees occur predominately on southern aspects and usually in conjunction with second growth lodgepole pine. There is also 24.9 acres of old growth Lodgepole Pine in Section 21. Within the State's ownership along the east side of the valley Sections 21 and 28 there is substantially more Douglas fir. Stands, 2, 3 (SLI) in Section 28, contain a scattered overstory of large 200 + year old fir with a multiple aged understory of second growth Douglas fir and lodgepole pine. Because lodgepole makes up the majority of stems per acre and volume they are classified as lodgepole pine stands. Section 21, Stand 9 has some Douglas fir greater than 30 inches DBH and over 200 years old.

The lodgepole stands in Section 5 are part of a larger patch of fairly unfragmented habitat to the

west including other ownerships, except for a Forest Service Road #4325 and some small cutting units (up to 40 acres in size) in Sections 18 and 7. Douglas fir stands in Sections 21 and 28 connect to an unharvested area in Sections 27, 22, 15, 10, and 3. Several species potentially found in the project area are associated with old growth habitats, such as flammulated owl, boreal owl, black-backed woodpecker, pileated woodpecker, northern goshawk, fisher, marten, and lynx (Henjum et al. 1994:184).

Old cutting units up to 40 acres in size are located northwest and southwest of the project area. Some of these stands have scattered old Douglas fir but most have no overstory cover and few remnant old growth attributes.

Old growth refers to forested areas that are in the later stages of stand development. They are generally dominated by relatively large old trees, contain a wide variety of tree sizes, exhibit some degree of multi-storied structure, have signs of decadence, such as rot and spike-topped trees, and contain standing snags and large down logs.

The State Land Board, who provides direction for management of trust lands, chose the Green et al. definition of Old Growth to be used for managing old growth on school trust lands. During project planning DNRC assessed and identified which stands met the Green et al. definition.

We have no way of knowing exactly how much old growth was present at any one time across the landscape. Historic age class distributions have been estimated, using historic forest inventory data from across western Montana (Losensky 1997).

The following table provides the current age class distributions for lodgepole pine stands at three different analysis levels.

Table 3-11
Age Class Distribution For Lodgepole Pine Stands
Within the Anaconda Unit

AGE CLASS	HISTORIC LEVELS (Losensky 1977)	ENTIRE UNIT AT PRESENT		ALL STATE LAND IN UPPER WILLOW CREEK, PRESENTLY		SALE AREA PRESENTLY	
		Ac.	%	Ac.	%	Ac.	%
Non-Stocked	9 %	0	0	0	0	0	0
1-40	34 %	515.5	9.8	126.6	6.2	0	0
41-100	43 %	2,316.7	44.3	1,542.5	74.8	1,300.7	76.9
101-Old Stand	10 %	1,701.3	32.5	201.5	9.8	201.5	11.9
Old Stand	4 %	699.9	13.4	189.6	9.2	189.6	11.2
Total		5,233.4		2,060.2		1,691.8	

In comparison to the historical age class distribution, existing stands at most levels of analysis are shifted toward older, 101-old stand and old stand, age classifications. This is likely due to

suppression of wildfires for the last 80 years and a lack of timber harvesting.

Existing Noxious Weeds

No noxious weeds were observed in the harvest area or on adjacent access roads. Knapweed does occur on spots of the Willow Creek access road. No sensitive plants are known to occur in the harvest area that would be affected by weed treatments.

CHAPTER 4 - ENVIRONMENTAL IMPACTS

This chapter describes environmental effects of each alternative on the resources described in Chapter 3 and contains the scientific and analytic basis for alternative comparison summarized in Chapter 2. It is organized in the same manner as Chapter 3, by general resource categories and their associated issues.

AFFECTED RESOURCES

Hydrology & Fisheries

This section addresses the anticipated effects of the proposed activities on water and fisheries resources within the affected watersheds. The primary concerns related to these resources are potential impacts to water quality and aquatic habitat and the effects of these impacts on downstream populations of bull trout and westslope cutthroat trout and other beneficial uses such as domestic, irrigation and livestock water uses. In order to address these issues the potential direct, indirect and cumulative effects of the proposed alternatives on sediment delivery, water yield, stream water temperature, large woody debris recruitment and fish habitat were analyzed.

The following 2 tables summarizes harvest and road activities proposed for each watershed analysis area under each of the proposed action alternatives:

Table 4-1.
Summary of Proposed Activities by Watershed Analysis Area

Watershed	Proposed Timber Sale Harvest (acres)				Proposed Post & Pole Harvest (acres)			
	Alternatives				Alternatives			
	A	B	C	D	A	B	C	D
Bear Cr.	0	30	30	30	0	88	96	88
Beaver Cr.	0	24	24	24	0	56	119	56
Huepeck Cr.	0	18	18	12	0	37	37	37
Unnamed Cr. Sec.17	0	35	35	5	0	33	33	33
Unnamed Cr. Sec. 21	0	7	7	0	0	0	0	0
Arbuckle Cr.	0	31	31	31	0	0	0	0
Slusser Cr.	0	13	18	18	0	0	0	0
Face Drainage	0	134	134	53	0	424	750	410
Total Upper Willow	0	297	297	173	0	667	1018	631

Table 4-2.
Summary of Proposed Road Activities by Watershed Analysis Area

Watershed	Proposed Road Construction (miles)				Proposed Road Improvements (miles)			
	Alternatives				Alternatives			
	A	B	C	D	A	B	C	D
Bear Cr.	0.0	.89	.89	.89	0.0	0	0	0
Beaver	0.0	0.74	0.74	0.72	0.0	0	0	0
Huepeck	0.0	0.93	0.93	0.93	0.0	0	0	0
Unnamed Sec.17	0.0	.85	.85	0.9	0.0	0	0	0
Unnamed Sec. 21	0.0	.08	.08	0.04	0.0	1.3	1.3	0
Arbuckle	0.0	0	0	0	0.0	0.50	0.50	1.95
Slusser	0.0	0	0	0	0.0	0.13	0.13	0
Face Drainage	0.0 0.0	1.57	1.57	.9	0.0 0.0	0.25	0.25	0.17
Total Upper Willow	0.0	5.06	5.06	4.38	0.0	2.18	2.18	2.12

Water Quality

The primary risks to water quality that are associated with the proposed timber sale are roads, especially roads located along or crossing streams. Risk of erosion and sediment delivery are highest when roads are located in areas with inadequate buffering between streams and other drainage features, on erosive soils, or on steep and/or unstable slopes. A lack of periodic maintenance and lack of adequate surface drainage features, and use during wet periods or conditions may also contribute to higher risk.

All existing roads and proposed road locations within and accessing the timber sale area have been reviewed and inventoried by a DNRC hydrologist and soil scientist. The existing roads and proposed road locations were evaluated to determine both existing and potential risk of erosion and sources of sediment delivery to streams. Many of the existing roads within the proposed sale area do not fully comply with BMPs. Several segments of existing road are eroding and were determined to be contributing direct sediment delivery to streams or at risk of contributing to direct delivery. Full details of the sediment source inventory are contained in the hydrology project file.

Timber harvest units can also directly impact water quality. Risk of erosion and subsequent sediment delivery are highest at landing areas and where ground based skidding occurs on steep slopes, in close proximity to streams and within ephemeral drainage features. Erosion within harvest units can be mitigated by selection of appropriate harvest and yarding

systems, proper location of skid trails, and restricting operation to appropriate season and ground conditions.

All of the proposed timber harvest units and post and rail thinning areas have been reviewed and evaluated in the field by a DNRC hydrologist and soil scientist. All wetlands and areas requiring SMZ delineation have also been field reviewed by a DNRC hydrologist to determine their adequacy in meeting the requirements of the Montana Streamside Management Law and in protecting water quality and aquatic resources.

Comparison of Alternatives

Alternatives B and C are virtually the same regarding proposed road developments and road improvements. Both alternatives would utilize the existing USFS Road #4325 to access the harvest units proposed in Sections 5, 8 and 17. Both Alternatives B and C would also use an existing BLM road to access the harvest units proposed in 21 and 28. Under both of these alternatives approximately 5.06 miles of new road and .1 miles (Alt B) along with .3 miles (Alt C) of temporary road would be constructed and approximately 2.18 miles of existing road would be reconstructed and improved to a standard that fully complies with BMPs. Another 0.6 miles of existing road would be permanently closed and abandoned under both of these alternatives (see road figures presented in Table 4.2 for a complete breakdown of proposed road work by watershed analysis area).

Approximately 1.04 miles of the new road construction planned under both of these alternatives is designed to relocate segments of existing road that contain steep grades, unimproved fords, and located in areas containing high water table and soils with low bearing capacity. Relocation of these segments is expected to reduce erosion and decrease long-term risk of water quality impacts.

Under Alternative B the new road construction includes a temporary bridge crossing of Bear Creek. Under Alternative C temporary bridges would be installed on both Bear and Beaver Creeks. Both Alternatives B and C include new culvert installations on Huepeck Gulch, Arbuckle Gulch, and the Unnamed Tributaries in Section 17 and Section 21. The temporary bridge crossings of Bear Creek and Beaver Creek would utilize a portable bridge structure designed with a large enough span to accommodate bankfull streamflow and to allow installation and removal to occur without any excavation or disturbance to the stream channel and stream bank. The crossing sites and road approaches to the crossing site will be re-vegetated and stabilized when the bridge structures are removed. No water quality impacts to Bear Creek or Beaver Creek are anticipated from the temporary stream crossing.

The new culvert installations proposed for, Arbuckle Gulch, Huepeck Gulch and the unnamed tributaries in Section 17 and Section 21 are considered low risk for sediment delivery and impacts to downstream water quality in Upper Willow Creek. Some short-term increases in sediment delivery to Huepeck Gulch, Arbuckle Gulch and the unnamed tributaries may occur during and/or shortly after the installation of the new culverts. However, application of BMPs, site-specific design and mitigation measures are expected to

- reduce erosion and potential sediment delivery to an acceptable level as defined under the Montana Water Quality Standards. Acceptable levels are defined as those conditions occurring where all reasonable land, soil, and water conservation practices have been applied.

The new culvert planned for Arbuckle is intended to replace an existing unimproved stream crossing. This installation is designed to reduce existing erosion and water quality impacts occurring at this site. No downstream delivery of sediment to Upper Willow Creek is anticipated. These other crossing sites are ephemeral or intermittent, and discontinuous with no direct delivery to down slope streams supporting cold-water fisheries or other sensitive beneficial uses.

Alternative D is also similar in regards to the road construction and road improvements proposed. Under this alternative the road layout is designed to circumvent old growth stands. This alternative proposes building 4.38 miles of new roads, and approximately 2.18 miles of existing road would be reconstructed and improved to a standard that fully complies with BMPs. Another 0.6 miles of existing road would be permanently closed and abandoned under this alternative.

The road construction proposed under this alternative also includes 1.04 miles of new road designed to relocate segments of existing road that contain steep grades, unimproved fords, and located in areas containing high water table and soils with low bearing capacity.

The new road construction planned under Alternative D also includes temporary bridge crossings of Bear Creek and Beaver Creek, and new culvert installations on Huepeck Gulch, Arbuckle Gulch, and the unnamed Tributaries in Section 17 and Section 21.

The temporary bridge crossings of Bear Creek and Beaver Creek would utilize portable bridge structures with similar designs with identical risk as those described under Alternative C.

The new culvert installations proposed for Huepeck Gulch, Arbuckle Gulch, and the Unnamed Tributaries in Section 17 and Section 21 are considered low risk to impact downstream water quality and beneficial uses as described under Alternatives B and C.

Timber sale harvest unit locations and acreage are similar under all three of the proposed action alternatives. The only differences between the action alternatives regarding timber harvest are the extent and location of proposed post and rail thinning, and the exclusion of old growth harvesting in Alternative D. No impacts to water quality or downstream beneficial uses are expected to result from the harvest activities proposed under any of the action alternatives. Streamside management zones and equipment restriction zones will be designed to effectively buffer streams and other ephemeral drainage features from harvest activities. No SMZ harvests are proposed under any of the action alternatives.

Ephemeral draws and other drainage features that lack discernable stream channels or are discontinuous drain most of the proposed harvest area. Selection of appropriate operating seasons, limiting equipment operations to suitable slopes or designated trails and appropriate ground conditions, and implementation of appropriate BMPs and mitigation measures will be used to reduce the risk and severity of soil erosion and potential sediment delivery to streams and ephemeral drainage features.

Action Alternatives B and C include plans for watershed restoration activities. These watershed restoration measures include: 1) Installation of a headgate structure at the existing Beaver Creek irrigation diversion, 2) stabilization of headcut and extensive gully erosion on existing irrigation ditch, 3) improvements designed to reduce erosion on existing roads, 4) relocation of several segments of poorly located existing road, and 5) abandonment and reclamation of several segments of existing roads.

There are some moderate risk of short-term increases in sediment delivery to Beaver Creek, Bear Creek and Upper Willow Creek during and/or shortly after the installation of the proposed headgate structure and gully stabilization measures on the existing irrigation ditch. However, application of BMPs, site-specific design and mitigation measures are expected to reduce erosion and potential sediment delivery to an acceptable level as defined under the Montana Water Quality Standards. Acceptable levels are defined as those conditions occurring where all reasonable land, soil, and water conservation practices have been applied. These restoration activities are expected to reduce long-term erosion and sediment delivery to Beaver Creek, Bear Creek and Upper Willow Creek.

The risk of water quality impacts that are associated with the proposed new road construction, temporary stream crossings, permanent culvert installations and timber harvest units are low. All of the proposed action alternatives include watershed and fisheries restoration measures that are designed to reduce sediment delivery to streams and ephemeral drainage features. The overall long-term effects of implementation of any of the proposed action alternatives would be improved water quality, improved protection of cold water fisheries and other downstream beneficial uses when compared to the current existing conditions. Action Alternative D also contains similar restoration activities proposed in Action Alternatives B and C. Although, in this alternative the gully erosion on an existing irrigation ditch will not be repaired due to economic concerns. This site of gully erosion has been identified as a significant source of sediment to Bear Creek. It is likely that the gully erosion will continue to be a long-term impact to water quality if no restoration activities are done to remedy this problem.

Risk of both short-term and long-term impacts to water quality are greatest under the no action alternative and Alternative D if we are unable to fix the ditch. This is due to the fact that watershed improvement projects designed to rehabilitate or mitigate existing sources of sediment would not be implemented under the no action alternative or Alternative D. Watershed rehabilitation measures would not be implemented because there would be no project or revenue to fund the proposed improvements. Of primary concern is the continued erosion and expansion of the large irrigation ditch gully. This gully has been identified as the single largest existing

source of sediment within the proposed sale area. Based on recent surveys it is estimated that approximately 23 tons of sediment/year is eroded from this gully and delivered directly into Bear Creek. Other potential sources of impact to water quality which are not addressed under the no action alternative are the poor condition of many of the existing roads within the proposed sale area and the presence of several unimproved stream crossings (fords).

Cumulative Watershed Effects

Cumulative watershed effects are off-site, hydrologic effects of the proposed actions when combined with past or other ongoing activities. Hydrologic effects include downstream changes in hydrology, channel stability, and sediment production, transport and storage. Existing cumulative watershed impacts due to increased water yield, flow alteration and channel instability appear to be largely attributed to the lack of flow regulation for the existing irrigation ditch diversion, severe irrigation ditch erosion and localized areas of concentrated livestock grazing.

A riparian grazing enclosure was constructed on the DNRC ownership in lower Bear Creek in 1996 to address stream bank instability caused or exasperated by concentrated livestock use. Stream bank stability and riparian vegetative cover within the enclosure have improved as expected. Additional recovery is expected as a riparian shrub community re-establishes.

Other cumulative watershed impacts are due to segments of existing road with direct sediment delivery to streams and ephemeral draw bottoms. Existing sediment sources were identified and inventoried during detailed sediment sources surveys completed by a DNRC hydrologist, a soil scientist and a private contractor.

The ECA method was used to predict the cumulative increases in average annual water yield for each watershed analysis area under each of the proposed action alternatives. This information was used to evaluate the potential for detrimental channel impacts due to increased intensity and duration of peak flows. The results of water yield modeling are summarized in the table listed below:

Table 4-3
Results of ECA / Water Yield Analysis

Watershed	Proposed ECA by Alternative (acres)				Cumulative Water Yield Increase by Alternative			
	A	B	C	D	A	B	C	D
Bear Cr.	11	84	84	84	0.6%	2.1%	2.1%	2.1%
Beaver Cr.	40	83	105	83	0.7%	2.1%	3.3%	2.1%
Huepeck Cr.	46	79	79	71	4.6%	7.1%	7.1%	6.6%
Unnamed Cr. Sec. 17	46	89	89	59	4.3%	7.7%	7.7%	5.4%
Unnamed Cr. Sec. 21	21	21	21	21	2.7%	2.7%	2.7%	2.7%

Arbuckle Cr.	6	37	37	37	0.6%	2.0%	2.0%	2.0%
Slusser Cr.	3	23	23	23	0.4%	1.9%	1.9%	1.9%

Comparison of Alternatives

The risk of detrimental levels of water yield increase due to timber harvest and new road construction is low for all affected watersheds under each of the proposed action alternatives. Predicted cumulative water yield increases for the entire Upper Willow Creek watershed are < 1% for all of the proposed action alternatives. Water yield increases for the tributary analysis area's range from 1.9% to 7.7% above natural conditions. These levels of water yield increase are below those levels normally associated with increased magnitude or duration of peak flows that would cause or contribute to detrimental channel impacts.

The predicted levels of water yield increase under all of the action alternatives are well below thresholds set for each watershed analysis area. Thresholds were specifically established for each watershed analysis area by a DNRC hydrologist using a risk matrix. Under this process thresholds are determined by considering acceptable levels of risk, watershed sensitivity (flow regime and channel conditions) and downstream resource values (beneficial uses). Thresholds for allowable increases in water yield were set at 8% for Upper Willow Creek, Bear Creek and Beaver Creek, and 12 % for all of the other watershed analysis areas.

Proposed action Alternatives B and C include watershed restoration activities designed to address all identified sources of erosion and potential sediment delivery to streams or ephemeral draw features. The proposed installation of a headgate structure and stabilization of the eroding irrigation ditch is expected to substantially reduce impacts caused by flow alteration, increased peak flows and increased sediment yields in lower Bear Creek. The irrigation ditch gully has been identified as the single largest existing source of sediment within the proposed sale area.

These restoration measures are expected to result in substantial long-term reduction in existing levels of sediment yield in Bear Creek and Upper Willow Creek. The risk of water quality impacts that are associated with the proposed action alternatives due to new road construction, temporary stream crossings, permanent culvert installations and timber harvest units are low. Some short-term increases in sediment delivery to Bear Creek and Upper Willow may result from installation of the headgate and stabilization of the irrigation ditch gully. However, the overall long-term effects of implementation of any of the proposed action alternatives would be reduced risk of cumulative impacts to water quality, cold water fisheries and other downstream beneficial uses when compared to the current existing conditions. Improved watershed conditions are also anticipated in Arbuckle and Slusser Gulch under any of the action alternatives due to the planned improvements to existing roads and stream crossings.

Action Alternative D includes some restoration activities including road reconstruction and abandonment, but does not address the gully erosion from the existing irrigation ditch. This area has been identified as an existing condition that contributes elevated levels of sediment

directly to the stream. Although, Action Alternative D may have the short-term increases of sedimentation associated with the restoration work, the long-term impacts of not addressing existing sources of sediment delivery is a risk to the water quality.

The no action alternative poses the highest risk of additional cumulative watershed impact occurring within the proposed sale area. The predicted long-term impacts to water quality are highest under this alternative because watershed improvement designed to rehabilitate or mitigate existing sources of sediment would not be implemented under no action alternative.

Cold Water Fisheries (Bull Trout and Westslope Cutthroat Trout)

The primary concern regarding the proposed action alternatives is the potential detrimental effects of increased sediment delivery to fish bearing streams. Elevated levels of sediment delivery and deposition in streams can pose risk to both bull trout and westslope cutthroat trout. Increased sedimentation in streams can affect trout populations in several ways. Direct impacts to trout usually occur during the early portion of the life cycle, incubating eggs or alevins. The most common direct effect of sediment upon trout populations occurs during egg incubation and fry emergence. Elevated levels of fine sediment (<6.4 mm) in spawning gravel can lead to a reduction in survival (Rieman and McIntyre 1993). This can occur when sediment actually surrounds the egg and prevents the exchange of oxygen. Sediment deposited on the surface of the streambed may entrap alevins and fry and prevent emergence.

Increased sediment delivery to streams can indirectly affect fish populations by altering fish habitat. High levels of sediment deposition can cause increased width/depth ratios, and pool filling, which results in a loss of habitat complexity. The filling of the spaces between cobbles in the stream substrate and of pool habitat can decrease hiding cover for juvenile fish and increase predation upon them.

Impacts to fish habitat can also occur through cumulative watershed effects. Extensive levels of timber harvest in a watershed can contribute to increased intensity and duration of peak flows. This can lead to decreased channel stability by increasing stream bank and channel erosion.

The potential effects of the activities proposed in each of the action alternatives on bull trout populations within the project area were evaluated using the diagnostic /pathways indicators contained in the baseline conditions assessment completed for bull trout in the Upper Willow Creek drainage by the Deerlodge National Forest (see following summary table).

Table 4-4
Summary of Anticipated Effects to Bull Trout in Upper Willow Creek Drainage

<u>Diagnostic/Pathways</u> : <u>Indicators</u>	<u>Major</u> <u>Effects of</u> <u>the</u> <u>Action(s)</u>	<u>Minor</u> <u>Effects of</u> <u>the</u> <u>Action(s)</u>	<u>Comments</u>
	Restore, Maintain, Degrade	Restore, Maintain, Degrade	
<u>Subpopulation</u> <u>Characteristics:</u>			
Subpopulation Size		D/R	Potential to be negatively affected by short term increase in sediment during or shortly after headgate installation and gully restoration activities. Positively affected by long-term decrease in sediment sources on State land.
Growth & Survival		D/R	"Same as above"
Life History Diversity & Isolation		D/R	"Same as above"
Persistence and Genetic Integrity		D/R	"Same as above"
<u>Water Quality:</u>			
Temperature		M	Streamside canopy maintained no SMZ harvest
Sediment		D/R	Short-term increase due to watershed restoration activities and a long-term decrease.
Chemical Contamination Nutrients		M	No herbicide treatment proposed in drainage.
<u>Habitat Access:</u>			
Physical Barriers		R	Restore flow in Lower Beaver Creek.
<u>Habitat Elements:</u>			
Substrate Embeddedness		D/R	Short-term increase and long-term decrease
Large Woody Debris		M	Potential LWD maintained no SMZ harvest.
Pool Frequency & Quality		M	

Large Pools		M	
Off-Channel Habitat		M	
Refugia		M	
<u>Channel Condition & Dynamics:</u>			
Wetted Width/Max Depth Ratio		M	
Streambank Condition		R	Improved conditions due to decreased water and sediment yield in lower Bear Creek
Floodplain Connectivity		M	
<u>Flow & Hydrology:</u>			
Change in Peak/Base Flows		R	Reduced peak flows in Bear Creek due to installation of headgate.
Drainage network Increase		M	
<u>Watershed Conditions:</u>			
Road Density & Location		D	Road density increased in Beaver Creek and Bear Creek. Roads located in low risk areas. Stream crossings temporary and low risk.
Disturbance History		M	
Riparian Conservation Area		M	
Disturbance Regime		M	
<u>Integration of Species & Habitat Condition</u>		M/R	Over all, all action alternatives result in long-term benefit.

All of the proposed action alternatives have low risk of negatively impacting bull trout populations or habitat in the Upper Willow Creek, Bear Creek or Beaver Creek watersheds. No major detrimental effects to bull trout are anticipated under any of the three action alternatives. Major effects are those that result in a change in baseline condition (e.g. from Functioning Appropriately to Functioning at Risk).

Minor effects are those actions that may result in an incremental or cumulative effect, but will not result in a functional change to the system (no change in functional level). Potential detrimental minor effects of the proposed action alternatives are limited to short-term increases in sediment delivery to Beaver Creek, Bear Creek and Upper Willow Creek during and shortly after the implementation of watershed / fisheries restoration activities that have been included in

each of the action alternatives, and increased long-term road densities in the Beaver Creek and Bear Creek drainage areas.

Under Alternatives B and C the proposed restoration activities include installation of a headgate structure at the irrigation ditch diversion of Beaver Creek and stabilization of the large gully formed on an irrigation ditch with direct delivery into Bear Creek and Upper Willow Creek. Other restoration activities include relocation and abandonment of several segments of road which have unimproved ford crossings and are located in close proximity to streams and other bodies of water. These measures are expected to result in a long-term reduction in sediment delivery from existing and potential sources on school trust land. For example, the installation of the headgate and erosion control / gully stabilization measures on the existing irrigation ditch are expected to result in at least an 80 % reduction in the amount of annual sediment delivery to Bear Creek. It is estimated that the gully currently contributes approximately 23 tons of sediment / year directly into Bear Creek.

Restoration work involved under Alternative D includes the relocation and abandonment of some existing road segments. These measures are also expected to result in some long-term reductions in sediment delivery from existing and potential sources on School Trust Lands, but not as much as Alternatives B or C.

Each of the proposed action alternatives would increase road densities in Bear Creek and Beaver Creek watershed. However, the risk of additional sediment delivery from the proposed road construction and temporary bridge crossings in Bear Creek and Beaver Creek are low. The proposed roads are located on relatively gentle and stable side slopes. They are well buffered from streams and ephemeral drainage features. All road drainage will be routed through adequate filtration zones and not be directed to streams, stream crossings, or ephemeral drainage features. No road construction is proposed within any SMZs except where necessary to cross a stream. The proposed stream crossings of Bear Creek and Beaver Creek will utilize temporary portable bridge structures. These structures have been designed with long spans that will not require excavation or disturbance of the stream channel or stream bank. The crossing sites will be stabilized and re-vegetated when the bridges are removed.

Existing conditions for stream temperature and potential large woody debris recruitment would be maintained under the proposed action. No timber harvests are proposed adjacent to streams or within the streamside management zones established on fish bearing streams within the project area. Streamside management zone delineation would comply with requirements contained in the Montana Streamside Management Law and Rules, and those contained in the State Forest Land Management Plan. Implementation of the SMZ Law and Rules, best management practices and site specific recommendations of DNRC hydrologist and soil scientist will minimize the potential for direct sediment delivery to streams from harvest areas and harvest activities.

Predicted increases in average annual water yield and peak flows are low in Upper Willow Creek and all of the other affected watershed analysis under each of the proposed action alternatives. Incremental increases in water yield due to the State proposal would not be substantial and cumulative increases would remain well below the established threshold levels. The risk of

cumulative watershed impacts to bull trout and cutthroat trout habitat due to increased water yield are low under all proposed action alternatives. A more detailed discussion on the potential for impacts due to cumulative watershed effects and establishing threshold levels is contained in the section of this report addressing “Cumulative Watershed Effects”.

No long-term major or minor detrimental effects resulting in decreased bull trout or westslope cutthroat trout populations and/or degraded habitat conditions are anticipated due to any of the proposed action alternatives. Implementation of any of the proposed action alternatives are expected to have a long-term major effect of restoring trout habitat in Beaver Creek and lower Bear Creek, and a long-term minor effect of partially restoring trout habitat in Upper Willow Creek.

The no action alternative and Action Alternative D presents the highest risk to bull trout and westslope cutthroat trout populations and habitat. Under these alternatives, watershed or fisheries improvement projects would not be implemented. This would result in continued degradation of trout habitat in Lower Bear Creek and Upper Willow Creek. Without gully stabilization measures, the existing irrigation ditch will continue to contribute large loads of sediment to Bear Creek and Upper Willow Creek.

Installation of a headgate at the irrigation diversion on Beaver Creek is included in Alternatives B and C. This restoration work is part of a separate contract with the Montana Department of Fish, Wildlife, and Parks. Installation of the headgate may increase the movement of bull trout and westslope cutthroat trout to fulfill migratory life histories and increase metapopulation dynamics. Headgate control may also increase the spread of the non-native brook trout, which may hybridize with bull trout or out compete westslope cutthroat trout.

Wildlife

Elk Security Cover

Alternative A--No Action Project and Analysis Areas

With no action, current conditions are not expected to change, with the exception of gradual forest successional changes over time. The project area consists of school trust parcels, totaling approximately 1,786 acres, in which timber harvesting and road construction are proposed (Sections 5, 8, 17, 21, and 28 in T8N, R15W; See Chapter 2 alternative maps). Elk security habitat, as defined by Hillis et al. (1991), are nonlinear blocks of hiding cover ≥ 250 acres in size and ≥ 0.5 miles from any open road. For this analysis, roads were considered closed if they were located behind locked gates during the hunting season. DNRC's road layer was used to identify roads in the area, and the 1996 Beaverhead-Deerlodge National Forest-Forest Visitor/Travel Map was used to identify seasonal road closures within the EAA.

Under this alternative, the amount of elk security habitat within the project area, approximately 1,066 acres (58.9% of the project area), would remain unchanged. However, risk of stand-

replacement fire and or insect mortality would increase over time and should either event occur would result in a short-term (15-20 year) cumulative negative effect until elk hiding cover would be restored.

Within the EAA, short-term changes from current conditions are not expected under this alternative, unless there is an insect infestation or stand replacing fire. Currently, there are approximately 10,644 acres (36.6% of the EAA) in elk security habitat, due to the presence of dense lodgepole pine stands and closed roads. However, there are over 2,122 acres of prior harvest activity within the EAA that would be expected to regenerate into suitable elk security habitat over the next 20 years. Such action would increase the amount of elk security habitat within the EAA to approximately 12,766 acres (43.8% of the EAA). However, the risk of stand-replacement fire or insect infestation also increases with time, and could have a negative effect on elk security.

Alternatives B, C, and D--Harvest Project and Analysis Areas

Under all three-action alternatives, overstory cover would be reduced through timber harvesting (Table 4-6). Alternative D would reduce overstory cover the least, and Alternative C would remove the most overstory cover. However, through both the low intensity and mixed severity harvests, forage production would likely be stimulated, while retaining hiding cover. This would likely benefit elk because it would reduce energy expenditures during the hunting season through intermixing forage and hiding cover. Over the long term, both low intensity and mixed severity harvests would likely reduce the risk of stand-replacement fire and beetle attack, because each prescription would reduce (1) the density of lodgepole pine (low intensity units) and (2) ladder fuels in stands with ponderosa pine and Douglas-fir in the overstory (mixed severity units). As a result, these units could lessen the impact future fires would have on elk hiding cover within the project area.

Stand replacement harvest units would likely provide both positive and negative effects for elk. Through stand replacement harvesting, more sunlight would reach the forest floor and stimulate forage production that would likely benefit local elk herds. These stand replacement units would also be well interspersed with elk hiding cover and could, as a result, reduce elk energy expenditures in traveling between hiding cover and foraging habitat during the hunting season. However, these harvest units would also produce a short-term (15-20 years) loss of hiding cover for elk until forest regeneration has sufficiently recovered to provide hiding cover.

Regarding road construction, Alternative D would construct the least amount of new road (4.38 miles), and Alternatives B and C would each construct 5.06 miles of new road (Table 4-5). While new road would be constructed under each action alternative, motorized access to the new roads would be controlled by a locked gate on USFS road 4325, which is closed to motorized access throughout the year. The locked gate would be an effective closure to motorized access, thus elk security habitat would not be reduced because new road construction would not increase open road density.

As mentioned above, the proposed new road construction would not reduce elk security habitat, following the Hillis et al. (1991) paradigm, because new roads would be closed due to the year-round locked gate on USFS Road #4325. However, new roads would afford walk-in hunters easier access and would likely temporarily change local elk movements until the resident elk herd became accustomed to habitat changes (Lyon 1998). In evaluating effects of the proposed action alternatives on elk security habitat, only those portions of proposed harvest units outside of the 0.5-mile open road buffers were included in likely reductions to elk security habitat. The proposed action alternatives would reduce elk security habitat within the project area from 58.9% to as low as 18.6% (Alternative C) within the project area, and from 36.6% to as low as 34.1% (Alternative B) within the EAA (Table 4-6). Of the total acreage within the EAA, approximately 2,122 acres have been previously harvested on DNRC and USFS lands, and are expected to regenerate into suitable elk security habitat over the next 15-20 years. Such re-growth would increase the amount of elk security habitat within the EAA by 7.2% for all action alternatives. Thus, the proposed harvests would reduce elk security habitat initially by up to 2.5% within the EAA, but there would also be an expected 7.2% increase over 15-20 years, for a net gain of 4.7% in elk security habitat over current conditions in approximately 15-20 years. Regrowth of prior harvesting would not affect elk security habitat within the project area. Thus, there would be direct negative short-term effects to elk security habitat within the project area as a result of the proposed action alternatives. However, there would be direct short-term negative effects within the EAA as a result of the proposed action alternatives, but long-term negative cumulative effects would likely be mitigated by substantial increases in hiding cover as a result of regrowth in pre-existing harvest units.

Table 4-5
Acres of proposed timber harvest and road construction for each action alternative

	Alternative A	Alternative B	Alternative C	Alternative D
New Road Construction (mi)	0	5.06	5.5	4.38
Road Reconstruction (mi)	0	2.18	2.18	2.18
Temporary Road (mi)	0	0.1	0.3	0.3
Low Intensity (post- and-rail)	0	667	1018	638
Mixed Severity	0	120	120	72
Stand Replacement	0	177	177	89
Total Harvest Acres	0	964	1,315	799

Table 4-6
Effects of the proposed action alternatives on elk security habitat.

		No Action A	Alternative B	Alternative C	Alternative D
Project Area Elk Security Habitat	Acres	1,066	449	337	469
	% of Area	58.9%	24.8%	18.6%	25.9%
Elk Analysis Area Security Habitat	Acres	10,644	10,027	9,915	10,047
	% of Area	36.6%	34.4%	34.1%	34.5%

Moose Habitat

Alternative A--No Action Project and Analysis Areas

Under this alternative, no changes from current conditions are expected with the exception of gradual successional changes to the forested community within both the project and analysis areas. With no action, the risk of stand-replacing fires and insect kill would increase. Depending on scale, stand-replacing fires could have positive or negative effects on moose habitat. Stand-replacing fires <300 acres in size would serve to create short-term (<20 years) high quality forage habitat for moose through overstory removal and stimulation of shrub growth. To a lesser extent similar responses would occur from insect kills of the same size. Such fires could produce positive effects for moose. However, fires >300 acres or which remove overstory cover within winter range habitats could remove large amounts of canopy cover that are required for winter shelter and summer thermal protection (Thompson and Stewart 1998). This would be a negative effect for moose habitat.

Alternatives B, C, and D--Harvest Project and Analysis Areas

Action alternatives would generate from 89 to 177 acres of stand replacement harvests (Table 4-5), ranging in size from 12 - 73 acres (Alts. B and C) and 12 - 22 acres (Alt. D). These stand replacement harvests would increase the amount of regenerating clearcut area within the project area from 0% of the project area to 6.8% (Alt. D) or 10.9% (Alt. B);(Alt. C)would be 10.2%. Within the Analysis area, proposed stand replacement harvests would be increased from 10.8% to 11.2% (Alt. D) or 11.5% (Alt. B; Alt. C would be 11.4%). Stand replacement harvests would also be well dispersed throughout the project area and would affect moose winter range habitat. As a result of stand replacement harvests, shrub growth would be stimulated and would likely benefit the local moose population. In montane habitats, Thompson and Stewart (1998) recommend that stand replacement harvests should be <247 acres, with maximum distances

between cutblock edges <328 yards, and no more than 14% of the entire winter range should be logged during any 30 year period. Within the analysis area currently there are approximately 1,666 acres of the 13,383 acres of moose winter range (roughly 12.4%) in regenerating stand replacement harvests. The proposed stand replacement harvests would increase this amount from 1% (Alt. D) to 1.5% (Alt. B). While moose habitat requires interspersed mature forest (i.e., cover) with forage-producing clearcuts to produce quality cover and forage availability (Euler 1981), sufficient overstory cover would be required to maintain winter shelter. There is low risk that the proposed stand replacement harvests under all action alternatives would damage moose winter range habitat.

The proposed action alternatives also provide for mixed severity and low intensity harvests within the project area (see Table 4-5 for acreages). Low intensity harvests would be designed to thin 2 to 6 inch dbh stands of lodgepole pine to a 10 to 12 foot spacing. Currently, the low intensity harvest stands have approximately 1,000 stems per acre and have closed canopies. However, such stand structure effectively prohibits establishment of a well-developed shrub layer that would benefit moose winter range forage. While the proposed thinning would open the canopy of affected stands, it would also allow sunlight to stimulate forb and shrub development on the forest floor, producing potential forage for moose. Additionally, all proposed actions are located >100 yards from riparian zones within the project area (Beaver Creek in Section 5, Bear Creek in Section 8, Huepeck Gulch in Section 17, and Arbuckle Gulch in Sections 21 and 28). Such areas are higher in percent shrub coverage and have lower tree densities than surrounding uplands, which make them likely avenues for moose travel corridors within the project and analysis areas (Van Dyke 1995). While proposed actions of low intensity harvests could produce winter forage for moose, the most effective use of affected stands by moose would likely be to provide shelter from snow. In mountain areas, such as the analysis area, moose move down to overwinter in river bottoms (i.e., Upper Willow Creek) vegetated with preferred foods, such as willow. Thus, moose would be more likely to seek shelter from abundant snows within closed canopied forest and venture into creek bottoms to forage on willow than to seek refuge and forage within dense lodgepole stands proposed for low intensity harvest. As a result, within the project area, proposed low intensity harvests would likely have a low to moderate risk of negative effects on moose winter range because proposed low intensity harvests would reduce the amount of closed canopied forest within the project area to between 47% (Alt. C) and 69% (Alt. D) and would be within 1 mile of foraging habitat along Upper Willow Creek. Within the larger analysis area, proposed low intensity harvests would likely have a low risk of negative effects to moose winter range due to the greater abundance of closed canopy forest within 1 mile of Upper Willow Creek in the analysis area.

Proposed mixed severity harvests would remove lodgepole pine from the affected stands, and favor ponderosa pine and Douglas fir as leave trees. This proposal would leave 10 to 70% of the overstory in the affected stands (DNRC stand level inventory data). Through the proposed removal of portions of overstory within the affected stands, forb and shrub growth within these stands would be stimulated, which would benefit moose. However, as winter range habitat, the proposed mixed severity harvests could further reduce the amount of closed canopy forest required for shelter from abundant snows that are in close proximity to foraging habitat (i.e., Upper Willow Creek). Thus, within the project area, proposed mixed severity harvests, in

combination with the proposed low intensity harvests, would likely have low to moderate risk of negative effects on moose winter range due to reduction in closed canopy forest within 1 mile of foraging habitat along Upper Willow Creek. Within the larger analysis area, proposed harvests (low and mixed severity) would likely have a low risk of negative effects to moose winter range due to the greater abundance of closed canopy forest within 1 mile of Upper Willow Creek in the analysis area, and potential creation of additional foraging habitat.

Additionally, the proposed action alternatives would construct either 4.38 or 5.06 miles of new road (Table 4-5) behind locked gates. Proposed new roads would have low risk of negative effects to moose habitat because they would not add additional motorized access to hunters. Proposed action alternatives would reduce the amount of closed canopied forest within moose winter range along Upper Willow Creek, with Alternative D removing the least amount of closed canopied forest, and Alternative C the most. However, all action alternatives are designed to facilitate moose travel corridors along Beaver and Bear Creeks, along with Huepeck and Arbuckle Gulches, which are areas with greater shrub coverage and lower tree densities. Thus, due to reductions in closed canopy forest within the project area, proposed action alternatives would likely have low to moderate risk of negative effects to moose winter range habitat within the project area, with Alternative D having the least potential for negative effects, and Alternative C the most. Within the analysis area, proposed action alternatives would create an interspersed of new potential foraging habitat with closed canopy forest and travel corridors. Due to the abundance of closed canopy forest within 1 mile of Upper Willow Creek that is outside of the project area, the proposed action alternatives would likely have low risk for negative effects to moose winter range habitat.

Threatened, endangered and sensitive animal species.

Lynx

Alternative A--No Action Project and Analysis Areas

With no action, current conditions are not expected to change, with the exception of gradual forest successional changes over time. However, the risk of stand replacing fire along with insect disease infestations would increase over time. Should a fire occur it would likely result in a short-term (15-20 year) cumulative positive effect for lynx because it would create early successional foraging habitat. Unfortunately, a stand replacing fire could also destroy potential denning habitat. Thus, under the no action alternative, creation of early successional lynx foraging habitat would be contingent upon the onset of stand replacing fires or future timber harvests on U. S. Forest Service lands. Risk of negative effects from direct, indirect, and cumulative effects to lynx under this alternative is low.

Alternatives B, C, and D--Harvest Project and Analysis Areas

Currently, there are 0 and approximately 835 acres of early foraging habitat available for lynx in

the project and analysis areas, respectively. For late successional foraging habitat, there are approximately 317 and 1,345 acres within the project and analysis areas, respectively. Proposed action alternatives would each have an effect on the amount and distribution of foraging habitat in both the project and analysis areas (Table 4-7). While early foraging habitat would increase under all action alternatives, the amount of late foraging, and potential denning, habitat would decrease. Overall, the potential reduction in late foraging habitat could have a direct negative effect on lynx foraging opportunities. Preliminary results of lynx foraging research indicates >70% of lynx foraging attempts occurred within late foraging habitat (J. Squires, U. S. Forest Service, pers. comm., December 2002). Due to the local moisture regime, effects of the proposed mixed severity and low intensity harvests would not attain late foraging habitat conditions for at least 40 years post-harvest. However, all proposed action alternatives are located >100 yards from riparian zones within the project area (Beaver Creek in Section 5, Bear Creek in Section 8, Huepeck Gulch in Section 17, and Arbuckle Gulch in Sections 21 and 28). Such areas are higher in percent shrub coverage, which would likely have higher snowshoe hare densities than surrounding uplands, and provide connective corridors to other late foraging habitat within the analysis area.

Each action alternative proposes construction of new roads and reconstruction of pre-existing roads (Table 4-5). While compaction of snow on roads by winter recreationists is thought to promote competition to lynx, by permitting other carnivores that are less adapted to snow to gain access to lynx winter foraging habitat, the proposed new road construction and reconstruction would be closed to public motorized access through a cooperative road management plan with the U. S. Forest Service. Thus, there would be low risk of negative effects to lynx as a result of the proposed actions with roads under the action alternatives.

While proposed action alternatives would likely provide low risk of long-term (>40 years) direct negative effects to lynx, due to the 5.5 - 13.2% decrease (Alt. D and C, respectively) in late foraging habitat within the analysis area, and new roads would be constructed, provision of connective corridors to other late foraging habitat may help mitigate these effects.

Table 4-7.
Projected quantities of early and late successional lynx foraging habitat as a result of the proposed action alternatives within the project and analysis areas

	Alternative A		Alternative B		Alternative C		Alternative D	
Foraging Habitat	Project Area	Analysis Area	Project Area	Analysis Area	Project Area	Analysis Area	Project Area	Analysis Area
Early (ac.)	0	835	197	1,032	184	1,019	124	959
Late (ac.)	317	1,345	134	1,162	131	1,159	243	1,271
Total (ac.)	317	2,190	331	2,194	315	2,178	367	2,230

Grizzly Bear

Alternative A--No Action Project and Analysis Areas

With no action, current conditions are not expected to change, with the exception of gradual forest successional changes over time. However, the risk of stand replacing fire and insect mortality would increase over time. If this type of fire occurred it would likely result in a short-term (15-20 year) cumulative negative effects to grizzly bears because of reduced visual screening and hiding cover, which are important habitat components to grizzly bear security. Risk of negative effects from direct, indirect, and cumulative effects to grizzly bears under this alternative is low.

Alternatives B, C, and D--Harvest Project and Analysis Areas

Within the project area, for all proposed action alternatives, only two harvest units, a 73 acre stand replacement harvest unit in Section 5 (present in Alternatives B and C), and a 17 acre stand replacement harvest unit in Section 8 (present in all action alternatives), would create openings that would be >600 feet from hiding cover. The 73-acre stand replacement unit would be approximately 1,300 feet wide, and the 17-acre unit would be approximately 670 feet wide. Because these two harvest units are predominately lodgepole pine and behind locked gates, the units would regenerate to provide grizzly bear hiding cover within 15 - 20 years, and grizzly bear vulnerability would not be as great as it would be if motorized access to the area were unrestricted, due to the proposed harvest of these 2 units.

Common to all action alternatives are travel corridors >100 yards wide along riparian zones within the project area (Beaver Creek in Section 5, Bear Creek in Section 8, Huepeck Gulch in Section 17, and Arbuckle Gulch in Sections 21 and 28). Such areas are higher in percent shrub coverage for hiding and visual screening cover, as well as grizzly bear forage species. Retention of these areas would benefit grizzly bears.

Each action alternative would construct between 4.38 and 5.06 miles of new road, and between 0.1 and 0.3 miles of temporary road, as well as reconstruct 2.18 miles of road (Table 4-8). The proposed road construction activities would not increase open road densities within the project or analysis areas because the activities would occur behind locked gates to restrict motorized access. Proposed activities would, however, increase total road densities within the project and analysis areas (Table 4-8).

Table 4-8

Total road densities (simple linear calculation) resulting from proposed action alternatives:

	Current TRD* (mi/mi ²)		NEW ROAD CONSTRUCTION (MI.)	Resulting TRD (mi/mi ²)	
	Project Area	Analysis Area		Project Area	Analysis Area
Alternative A	1.1	1.93	0.0	1.1	1.93
Alternative B	1.1	1.93	5.06	3.7	1.94
Alternative C	1.1	1.93	5.06	3.7	1.94
Alternative D	1.1	1.93	4.38	3.4	1.94

*Total road density

Due to uncertainty associated with grizzly bear presence in the area (J. Jonkel, MT FWP, pers. comm., November 2002), and the level of restricted motorized access within both the project and analysis areas, there is a low level of direct, indirect, or cumulative negative effects to grizzly bears as a result of the proposed action alternatives.

Gray Wolf

Alternative A--No Action Project and Analysis Areas

Because of wolves' large home range, the grizzly bear analysis area will also be used for the wolf landscape analysis. With no action, current conditions are not expected to change, with the exception of gradual forest successional changes over time and possible stand replacing events caused by insects disease or fire. However, the risk of stand replacing fire would increase over time and would likely result in a short-term (15-20 year) cumulative negative effects to wolves because it could reduce visual screening and hiding cover, which are important habitat components to wolf security. Risk of negative effects from direct, indirect, and cumulative effects to wolves under this alternative is low.

Alternatives B, C, and D--Harvest Project and Analysis Areas

Although not currently present, wolves could use the project and analysis areas. Under all action alternatives, there would be a reduction in visual screening cover, most notably through stand replacement harvests. Both low intensity and mixed severity harvests would have minimal indirect impact on wolves because each harvest type would leave trees for visual screening cover. Removal of screening cover, as in the proposed stand replacement harvests, would leave wolves crossing the proposed clearings potentially vulnerable to hunters through misidentification (i.e., confusing a wolf with a coyote). However, all three types of proposed harvest (stand replacement, low intensity, and mixed severity) could produce indirect benefits to wolves

through stimulation of forage production for deer, elk, and moose that reside within the project and analysis areas.

Road densities likely have some influence on wolf security. Each action alternative would construct between 4.38 and 5.06 miles of new road, and between 0.1 and 0.3 miles of temporary road, as well as 2.18 miles of reconstructed road (Table 4-8). Proposed road construction activities would not likely influence wolf security because open road densities within the project and analysis areas would not be increased because the activities would occur behind locked gates to restrict motorized access. Proposed activities would, however, increase total road densities within the project and analysis areas (Table 4-8).

Finally, common to all action alternatives are travel corridors >100 yards wide along riparian zones within the project area (Beaver Creek in Section 5, Bear Creek in Section 8, Huepeck Gulch in Section 17, and Arbuckle Gulch in Sections 21 and 28). Such areas are higher in percent shrub coverage for hiding and visual screening cover. Thus, among the action alternatives, Alternative D would have the least effect on wolves because it constructs the least amount of road and removes the least amount of timber through stand replacement harvest. Overall, each action alternative has a low risk for negative direct, indirect, and cumulative negative effects to wolves.

Black-backed woodpecker

Alternative A--No Action Project and Analysis Areas

The analysis area for the black-backed woodpecker will encompass the project area and extend for a one-mile radius from affected DNRC parcels. Under the no action alternative, no change from current conditions are expected. However, current stand densities are likely to persist and may attract an insect infestation or increase the risk for stand replacement fire. High tree densities often promote conditions considered desirable by forest insects because the increased competition from trees also increases the stress individual trees experience, making them vulnerable to infestation by insects. High tree densities also increase stand replacement fire risk due to the presence of ladder fuels and downed wood. Both insect infestations and post-fire stands are considered desirable to black-backed woodpeckers because of abundant food sources. Thus, over time, no action may benefit black-backed woodpeckers.

Alternatives B, C, and D--Harvest Project and Analysis Areas

Black-backed woodpecker populations appear to do best where wood-boring insects are increasing and in post-stand-replacement fire habitat (Settingington et al. 2000). Currently, neither condition exists within the project or analysis areas. However, currently 70% of the analysis area and 100% of the project area consist of dense lodgepole pine stands that could be subject to insect infestation as a result of overstocking within the stand over time. Additionally, as a result of current stocking within the project and analysis areas, stands would be subject to

self-thinning with increases in average stand diameter, which would subsequently increase downed wood and risk of stand replacement fire. Thus, through all proposed harvest actions, the risk of insect infestation and stand replacement fire would be reduced. As a result, over a long time frame (20 - 70 years), reduced stand densities would have an indirect negative effect on black-backed woodpeckers because there would be a possibility that future habitat might not be created. Thus, the risk of negative effects to black-backed woodpeckers would be low as a result of all action alternatives.

Flammulated Owl

Alternative A--No Action Project and Analysis Areas

Under this alternative, no changes from current conditions are expected with the exception of gradual successional changes to the forested community within both project and analysis areas. With no action, the risk of stand-replacing fires or insect outbreaks would increase.

Alternatives B, C, and D--Harvest Project and Analysis Areas

Due to the flammulated owl's relatively small home range (<50 acres), analysis and project areas are the same. Thus, within this area, there are approximately 331 acres of preferred habitat types (e.g., Douglas-fir/pinegrass, Douglas-fir/dwarf huckleberry), of which, approximately 55 acres would be considered suitable habitat because they are mature to old aged, mixed pine and Douglas fir stands (Stand Level Inventory database). Proposed action alternatives would affect approximately 141 ac. (Alt. B), 231 ac. (Alt. C.), and 126 ac. (Alt. D) of preferred flammulated owl habitat types. Of the affected portions of stands proposed for harvest with preferred flammulated owl habitat types, only a few acres would be considered suitable habitat (Table 4-9), with the remaining acreage containing smaller diameter lodgepole pine. Under all three action alternatives, approximately 53% of the 55 acres of suitable habitat would be harvested to some degree, with harvests that resemble stand replacement fires impacting flammulated owl habitat the most. Depending upon the intensity of each harvest, harvests that resemble low intensity and mixed severity fires could benefit flammulated owl habitat through reductions in stem densities that would promote understory shrub growth and subsequent insect production. Over sufficient time (possibly >30 years), harvests that resemble low intensity and mixed severity fires would benefit flammulated owls because competitive exclusion within affected stands would be reduced, facilitating accelerated growth among remaining individuals and would promote multi-storied conditions within the future stand. As a result, there would be low risk of negative effects to flammulated owls under action alternatives. Of the action alternatives, Alternative D would likely have the least impact on flammulated owls because no suitable habitat would be subject to a harvest that resembles a stand replacement fire (Table 4-9).

Affected acres of suitable flammulated owl habitat, by action alternative and harvest intensity. Within the project and analysis areas, there are approximately 331 acres of flammulated owl preferred habitat types (Stand Level Inventory database), of which, approximately 55 acres could

be considered suitable flammulated owl habitat.

Table 4-9
Flammulated Owl Habitat

Alternative	Harvest Type	Affected Suitable Habitat ^a (ac.)	Preferred Habitat Types ^b (ac.)	Percent Suitable Affected ^c
A				
	Total	0	0	0
B	Stand Replacement	12	16	21.8
	Low Intensity	14	62	25.5
	Mixed Severity	3	63	5.5
	Total	29	141	52.7
C	Stand Replacement	0	4	0
	Low Intensity	13	152	23.6
	Mixed Severity	16	75	29.1
	Total	29	231	52.7
D	Stand Replacement	13	16	23.6
	Low Intensity	13	62	23.6
	Mixed Severity	3	47	5.5
	Total	29	125	52.7

^a Acres of flammulated owl preferred habitat types that are multi-storied mature to old growth stands and would be affected by proposed harvests.

^b Acres of flammulated owl preferred habitat types that would be affected by proposed harvests.

^c Percentage of suitable flammulated owl habitat affected by harvest type (affected suitable habitat divided by amount of suitable habitat within project and analysis area [55 ac.]).

Boreal Owl

Alternative A--No Action

Project and Analysis Areas

Under this alternative, no changes from current conditions are expected with the exception of gradual successional changes to the forested community within both the project and analysis areas. With no action, the risk of stand-replacing fires and insect epidemics would increase.

Alternatives B, C, and D--Harvest

Project and Analysis Areas

With boreal owl's small home range, the analysis area for this species is also the project area. Within these bounds, there are approximately 1,362 acres of habitat types that boreal owls prefer. However, approximately 175 acres would currently be suitable for boreal owls due to structural development, and over half of these acres would be subject to the proposed actions. Of the

suitable habitat acreage, Alternative D would harvest the least (6.3%), and Alternatives B and C the most (55%; Table 4-10). Of the action alternatives, Alternative D would likely also have the least negative impact because it would harvest the least amount of suitable habitat through stand replacement harvests (8 acres for 4.6% of suitable boreal owl habitat). Of the remaining preferred habitat types in the project area, the three action alternatives would harvest between 600 and 934 acres (44 - 69%), largely through harvests that resemble low intensity and mixed severity fires (Table 4-10). These harvest practices would likely result in stands with accelerated growth rates that would achieve suitable boreal owl habitat conditions earlier than if left alone. As a result, the action alternatives would likely have low risk of negative effects on boreal owls.

Affected acres of suitable boreal owl habitat, by action alternative and harvest intensity. Within the project and analysis areas, there are approximately 1,362 acres of boreal owl preferred habitat types (Stand Level Inventory database), of which, approximately 175 acres could be considered suitable boreal owl habitat.

Table 4-10
Boreal Owl Habitat

Alternative	Harvest Type	Affected Suitable Habitat^a (ac.)	Preferred Habitat Types^b (ac.)	Percent Suitable Affected^c
A				
	Total	0	0	0
B	Stand Replacement	72	165	41.1
	Low Intensity	5	519	2.9
	Mixed Severity	19	45	10.9
	Total	96	729	54.9
C	Stand Replacement	72	165	41.1
	Low Intensity	5	724	2.9
	Mixed Severity	19	45	10.9
	Total	96	934	54.9
D	Stand Replacement	8	93	4.6
	Low Intensity	3	489	1.7
	Mixed Severity	0	19	0
	Total	11	601	6.3

^a Acres of boreal owl preferred habitat types that are multi-storied mature to old growth stands and would be affected by proposed harvests.

^b Acres of boreal owl preferred habitat types that would be affected by proposed harvests.

^c Percentage of suitable boreal owl habitat affected by harvest type (affected suitable habitat divided by amount of suitable habitat within project and analysis area [175 ac.]).

Northern Goshawk

The northern goshawk is a foraging habitat generalist species known to nest in a variety of stand conditions, from stem exclusion to old growth. In Wyoming, goshawks nested extensively in lodgepole pine stands (Squires and Ruggiero 1996). Throughout Oregon and Washington, goshawks nested in a variety of forest stand structures and species composition, with nest trees ranging from 9 - 50 inches dbh and nest stand basal area averaging $>76 \text{ ft}^2/\text{ac}$ (lower 95% confidence interval; McGrath et al. 2003). Because goshawks have home ranges >5000 acres, the analysis area includes the project area and extends for a 1-mile radius from its borders. Within the analysis area, there are at least 304 acres of potential nesting habitat spread throughout the DNRC parcels that have an average stand diameter ≥ 9 inches dbh with a basal area $\geq 70 \text{ ft}^2/\text{ac}$, after querying the Stand Level Inventory database, and approximately 143 acres within the project area. Of these acres, approximately 79 acres of potential nesting habitat would be affected by the proposed actions (Table 4-11). Thus, approximately 45% and 74% of the potential nesting habitat within the project and analysis areas, respectively, would not be affected by the proposed actions. Additionally, proposed harvests that resemble mixed severity fires in Alternatives B and C would likely accelerate the schedule by which approximately 41 acres (Alt. B) and 54 acres (Alt. C) of habitat would likely become potential nesting habitat. The affected stands currently have the necessary minimum average stand diameter, but are deficient in basal area. Through harvests that resemble mixed severity fires in these stands, competition would be reduced among the remaining ponderosa pine and Douglas-fir, and their respective basal areas would increase more rapidly than if the stands were not thinned. Additionally, at least 53% of the potential goshawk-nesting habitat occurs outside of the project area and would remain unharvested under each action alternative.

Most of the analysis area's potential nesting habitat occurs within Section 16, T8N, R15W, and is fragmented by prior harvest activities and pastureland. However, it is connected with suitable habitat on adjacent USFS land in Section 15. Based on the fragmentation pattern and topography within Section 16, the most likely location for nesting would be within a draw feature along the south-central boundary of the section (McGrath et al. 2003). Thus, with potential nesting habitat on DNRC lands in Section 16, and adjacent habitat on USFS lands in Sections 15, 22, and 27, the proposed action alternatives would likely have low risk of negative effects on goshawk nesting habitat.

Affected acres of potentially suitable goshawk nesting habitat, by action alternative and harvest intensity. Potential nesting habitat was identified by the Stand Level Inventory as stands with an average stand diameter ≥ 9 inches dbh and basal area $\geq 70 \text{ ft}^2/\text{ac}$. Within the project and analysis areas, there are at least 143 and 304 acres, respectively, of potential nesting habitat (Stand Level Inventory database).

**Table 4-11
Northern Goshawk Habitat**

Alternative	Harvest Type	Affected Suitable Habitat ^a (ac.)	Project Area Percent Affected ^b	Analysis Area Percent Affected ^c
A				
	Total	0	0	0
B, C, D	Stand Replacement	19	13.3	6.3
	Low Intensity	13	9.1	4.3
	Mixed Severity	47	32.9	15.5
	Total	79	55.3	26.1

^a Acres of potential goshawk nesting habitat, as defined in title, that would be affected by proposed harvests.

^b Percentage of potential nesting habitat affected by harvest type (affected nesting habitat divided by amount of suitable habitat within project area [143 ac.]).

^c Percentage of potential nesting habitat affected by harvest type (affected nesting habitat divided by amount of suitable habitat within project area [304 ac.]).

ENVIRONMENTAL EFFECTS ON SOILS & MITIGATION MEASURES

Alternative A.

The no action alternative would have some continued effects on soils. No harvest or road repair would occur and existing roads with inadequate drainage would continue to erode without maintenance. Some chronic erosion, and sedimentation along the segment of the irrigation ditch in SE¼ of Section 8 would continue, (refer to watershed and fisheries effects section). Forest health would continue to decline on overstocked areas, due to increasing competition for limited soil nutrients and moisture.

Harvest Effects common to action alternatives

Primary soil concerns are potential displacement associated with soil disturbance during road construction, harvest operations and site preparation. Potential site impacts are difficulty with regeneration, reduced site productivity and increased runoff and erosion. Susceptibility to impact varies with soils type, harvest method, type of equipment and season of use. Natural sediment rates and potential surface erosion were considered for all soils in the watershed.

Ground-based skidding with rubber-tired skidders, tractors or harvesters is the most economical methods of timber harvest and best suited to well-drained soils of moderate slope. Skidders and tractors have a higher risk of affecting soils through displacement, compaction and area of disturbance, compared to in woods processors and forwarders. Main skid trails can become compacted and reduce the long-term productivity of the site. The area and degree of soil impacts would be mitigated by avoiding skidding on steep slopes, skid trail planning, avoiding operations when wet and installing erosion control features where needed. Most sensitive soils are wet sites

and steep slopes which will be avoided or protected through implementation of BMPs , equipment restriction zones and site specific mitigation measures of the Soil Scientist and Hydrologist to minimize the area and degree of soil effects associated with proposed harvest and road construction. We expect harvest effects on soils would be similar on a per acre basis for conventional and post and rail harvest for each alternative (refer to table 4-12).

Harvest and brush piling operations would be planned to retain organic matter, avoid excessive displacement of topsoils and restrict season of use to minimize effects. Maintaining a portion of coarse woody debris similar to natural conditions (Graham et al. 1996) and a majority of fine needles/foliage helps insure nutrient cycling essential for future plant growth. Woody debris would be retained at 10 to 15 tons/acre on stand replacing harvest areas and 5-10 tons/acre on the mixed severity harvest areas, to promote long-term soil stability and productivity. Site preparation will limit the amount of surface disturbance to the minimum required for silvicultural goals. Site preparation would cause slight soil disturbance by mixing surface duff to expose mineral soil and would have low, short-term effects to soils and promote tree regeneration. Impacts to soils would be minimized and soil productivity maintained if BMPs, and recommended mitigation measures are implemented to control or reduce the area and degree of soil impacts. Forest health would improve on thinned areas, due to reduced competition for limited soil nutrients and moisture.

Table 4-12
Summary of Timber Harvest Effects on Soil Resources

Alternative	Stand replacing, Harvest acres *	Mixed severity Harvest acres #	Low intensity Harvest / thinning (Post & pole) #	Estimated Maximum acres of Harvest effects on skid trails and landings
A	0	0	0	0
B	26.6 ac.	12 ac.	63.8 ac.	102.4 ac. = 10.9% of 935 ac.
C	26.6 ac.	12 ac.	103.6 ac.	142 ac. = 10.6% of 1333 ac.
D	13.4 ac.	8.4 ac.	62.4 ac.	84.2 ac. = 10.6% of 797 ac.

* Assumes up to maximum 15 % of area impacted by skid trails and disturbance.

Assumes up to maximum 10 % of area impacted by skid trails and disturbance

Road Access & Effects of action alternatives:

Road systems were designed to minimize the number of road miles, control erosion and provide resource protection with the most economical construction and lowest maintenance required. New road construction through forested sites would reduce forest soil productivity and convert these sites to mainly grass, but would have little effect on range sites, (refer to table 4-13). All action alternatives will implement BMPs, and site-specific mitigation measures on roads and harvest areas to maintain slope stability and provide adequate drainage to control erosion and sedimentation. Construction of all stream crossings will implement mitigation measures to control sediment.

Table 4-13
Road Mileage Comparison by Alternatives

Road Mileage Comparison by ALT.	ALT. A	ALT. B	ALT. C	ALT. D
Road New Construction	0	5.06 mi.	5.06 mi.	4.38 mi.
Road Reconstruction	0	2.18 mi	2.18 mi.	2.18 mi.
Temporary road	0	0.1 mi.	0.3 mi.	0.3 mi.

Temporary roads with winter limitations, and post cutter roads would have minimal effect on soil displacement but could result in compaction. Impacts for temporary local could result in 50% growth reduction on the travel way for the life of the stand but represent less than ½ percent of the project area. Following use, temporary roads would be closed and have long-term drainage features installed and reseeding with grass.

Road reconstruction would be similar for all action alternatives (2.18 miles). Existing access roads can be used as is with some localized repairs, minor relocation and maintenance. A road inventory of required repairs, improvements and maintenance needs will be completed for the chosen alternative. Road drainage would be installed concurrent with new road construction and will be maintained.

Road use will be limited to relatively dry, <20% soil moisture, or frozen conditions to maintain drainage and road improvements and reduce road costs. Segments of roads will be graveled, such as stream crossings and segments of road that cross clayey soils that severely limit season of use. The gravel source required for road construction would be designed to remove less than 1 acre out of timber production. Source area would be located on a dry site of moderate slopes and would require prompt revegetation in accordance with reclamation law.

Alternative B & C

These alternatives would both construct about 5.06 miles of new road extending from an existing forest service system road. Between .1 and .3 miles of temporary road would be designed with minimal excavation and stabilized after use. Reconstruction would maintain or improve drainage on 2.18 miles of existing roads.

Timber harvest would be completed by conventional ground skidding, and post and rail harvest. Alternative C would have about 351 acres of additional low intensity harvest (post and pole thinning) than Alternative B. post and rail harvesting would have negligible ground disturbing effects on soils (estimated at 10% of area treated) and presents low risk of erosion as long as standard harvest mitigations for skid trail spacing and season of use are implemented. Tractor harvest units would likely incur similar ground effects as the other action alternatives on a proportional basis. With action alternatives B and C, the eroded irrigation gully would be reshaped and stabilized with grass and shrubs to reduce chronic erosion and sedimentation into

Bear Creek (refer to hydrology section). Stabilization of the gully site would be a substantial long-term improvement in sediment reduction compared to the No-Action Alternative.

Alternative D

This alternative would construct about 4.38 miles of new road, which is approximately 0.7 miles less than Alternatives B & C. Segments of the new road are on different alignments than other alternatives to avoid old growth designated stands. Alternative C and D would have one additional bridge crossing on Beaver Creek, where Alternative B would not. The bridge would be installed with gravel approaches to prevent rutting, erosion and sedimentation.

Timber harvest would be completed by conventional ground skidding, and post and pole harvest. Alternative D, low intensity harvest (post and pole thinning) would thin about 380 less acres than Alternative C and 29 acres less than Alternative B. Tractor harvest units would incur similar ground effects as the other action alternatives on a proportional basis but would involve fewer acres than alternatives B and C.

With Alternative D, the eroded irrigation gully in SE¼ of Section 8 would not be reshaped and stabilized and chronic erosion and sedimentation into Bear Creek would continue (refer to hydrology section) similar to the no-action Alternative A.

Cumulative effects to soil productivity

Cumulative effects could occur from repeated ground based entries into the harvest area. The limited area of past thinning projects has left minimal effect on the soils, with few trails still evident. All Action alternatives would control the area of soil effects associated with timber harvest by skid trail planning and minimizing disturbance to that needed for silvicultural goals as noted in the mitigation measures. Proposed post and pole harvest would have negligible effects as long as contractors are required to implement the same mitigation measures for season of use, avoid wet sites and install adequate drainage in trails and roads. Temporary roads would be stabilized and revegetated. Any future harvest would likely use the same road system and existing trails and landings and therefore presents low risk of cumulative effects. Large woody debris will be retained for nutrient cycling and long-term productivity and therefore presents low risk of cumulative effects to soil productivity.

Visual

Alternative A

There would not be any significant change to the landscape in the near term. The existing mosaic of textures and color variation would continue. At some point in the future fire or insects will play their natural role within this ecosystem as a cleansing and thinning agent. It is likely that, due to long-term fire suppression and resulting fuels buildup, future fire occurrences would be larger and of higher intensity than occurred historically. Openings created by these fires would be larger and more expansive than those proposed under any of the action alternatives.

The texture and color variations visible from the Upper Willow Creek county road would remain as they presently are until fire or insects modifies the situation.

Alternative B, C, & D

Sawlog Harvesting

Timber harvesting as proposed under each of these alternatives would have similar impacts on the view shed so they will all be discussed as one. The primary location for viewing the project area is from the county road. Portions of the school trust land would also be visible from U.S. Forest Service Road #4325 and the old Black Pine lookout.

Road #4325 is closed, by a locked gate, year around, to recreational use. Vehicular traffic is authorized for individuals who are working on U.S. Forest Service timber permits and to individuals involved with State or Federal land management who receive authorization from the Pintlar Ranger District to use this road. Because of its very limited use any visual impacts would not be noticed by the general public from this road.

For hikers, hunters and recreationists who walk this road there would be a change in their viewshed. Only one sawlog harvest unit, 23 acres in the NW¼ of Section 17 would be visible. Post and rail thinning in Sections 17 and 5 would also be visible. Thinning units would appear more open than they currently are. This would give them a more park like appearance. The one-sawlog harvest unit is going to have a more patchy appearance. Large diameter Douglas fir and ponderosa pine are to be retained on a natural spacing. Most of those, which are present, will be retained. This will leave openings when lodgepole pine has been removed along with clumps of fir and pine, which have been retained. There are older cutting units on USFS land, which have the same appearance.

The Black Pine Lookout road is in poor condition but does receive some limited use during the summer and fall. This road is located to the east of the project area on Black Pine Ridge. It provides a good view of all the lands in the Upper Willow Creek Drainage. Existing harvest units on private and U.S.F.S. lands are clearly visible from this location. Harvesting of sawlogs would change the view as seen from this vantage point. Unharvested stands of lodgepole pine would be harvested and that would create openings. These openings would generally follow existing stand boundaries and would mimic past fire occurrences. Immediately following harvesting and slash disposal, units would be a mixture of brown from drying slash, black from burned areas and green associated with the flush of new grass and forbs. Over time, 15-20 years, lodgepole pine regeneration would begin to dominate stand replacement and mixed severity cutting units. The harvesting would create a wider diversity in texture and color within the school trust land.

Portions of harvest units in Sections 5, 17, and 21 would be visible from the county road. Harvesting in Section 21 would be immediately adjacent to the road and would be highly visible. There is a partial screen of multiple aged lodgepole pine located on adjacent private land that is

located along the west boundary of State ownership. Even with the existing screen, portions of the cutting unit and new road construction road would be visible. Because of the close proximity to the county road individual stumps, skid trails and landings would be visible. This particular timber stand is lodgepole pine that is infested with mistletoe that was thinned approximately 25 years ago by the Bureau of Land Management. Portions of clearcuts in Section 5 and 17 would be visible from the county road and would stand out in contrast to adjacent second growth stands. Depending on how much money and manpower, which is available, as well as weather conditions, some of the clearcut and selective harvest units would be burned to promote regeneration and reduce fuels. These units would stand out in contrast to adjacent timber modifying the view shed.

New Roads

Under the action alternatives the amount of new road construction varies from 4.38 to 5.06 miles. There is also additional reconstruction and use of temporary roads. New construction would be intermittently visible within all of the sections either by traveling on the road itself or as a linear change in texture. Road visibility would be a function of topography, on flat slopes very little changes would be noticed. While on steeper hillsides the road cutslope would be visible.

Post and Rail Harvesting

Alternatives B, C, and D all propose to harvest second growth lodgepole pine through thinning, mimicking either a low intensity or mixed severity fire. In small patches, where dominant second growth trees are not of sufficient health to respond to additional growing space, small patches, <5 acres each, would have all of the trees removed. These small openings would not exceed 10 percent of the entire unit. Impacts to the visual resource would involve a slight change in the texture visible from the county road and Black Pine Lookout along with occasional small patch openings. Thinning would also change the texture from fine to coarse. Roads associated with this harvesting would generally not be visible and are not anticipated to impact the visual resource. It would take 15 to 20 years from the canopy of these stands to grow back together and return to their current fine-grained texture.

Vegetation

Old Growth Habitat

Alternative A & D

Direct and Indirect Effects:

Without harvest, decadence would continue to increase in lodgepole stands. Eventually, stands would likely succumb to a stand-replacement fire, or extensive insect infestation. Mature lodgepole in Section 5 contains some trees with fire scars, indicating that cool underburns have occurred in the past. However, given the large amount of dead material and ladder fuels currently present, it is not likely that a fire would remain on the ground and result in a cool underburn. It is not likely that lodgepole stands would be retained as old growth long into the

future. In the absence of fire the stands would continue to move toward a climax condition where Alpine fir becomes the codominate on dominate species. In stands where there is a substantial amount of Douglas fir or ponderosa pine, understory trees would continue to compete with larger, older trees in the absence of harvesting. Large trees would die and provide snag habitat in the short-term. However, fewer medium-sized trees would grow to the large-sizes preferred for old growth than if stands were thinned. In addition, without openings in the stands, fewer ponderosa pine and Douglas fir could become established, eventually interrupting the supply of large-sized trees. Without harvest, the risk of a stand-replacing fire would be greater than if thinning occurred. This would, logically, be followed by a long-term decrease in large sized live and dead trees. Eventually, this would result in less recruitment of large pieces of coarse woody debris. The increased risk of a stand-replacement fire would be a long-term negative effect to retention and recruitment of old growth habitats and components.

Alternatives B & C

Direct and Indirect Effect

Approximately 123 acres of Lodgepole pine old growth would be harvested under these alternatives. Several thousand acres of lodgepole old growth would remain un-harvested in portions of the Upper Willow Creek Drainage mainly on USFS ground. Therefore, there would be negative direct effects where harvest occurred. This would be somewhat mitigated by the large amount of unaltered habitat in the drainage. Given that context, there would be low cumulative negative effects throughout the drainage with stand-replacement harvest in the lodgepole stands in the project area.

If an action alternative is implemented those stands which are harvested to emulate the occurrence of a stand replacing fire would have very few snags retained. The northern portion would be snag deficient from habitat available on DNRC ownership. From a wildlife perspective, lack of snags in lodgepole stands is partly tempered because lodgepole pine snags are generally used less than expected based on availability. The exception would be use by black-backed woodpeckers.

Planned mixed severity harvests would thin stands, with the largest Douglas fir and ponderosa pine being retained post-harvest. Therefore, the best quality old growth components would be retained and conditions for their continued growth would be improved. This would benefit old growth components and old growth stands. Effects would be proportional to the number of trees removed. Based on past harvest, this amount is generally 5% (or less) of all large trees on site. Large coarse woody debris would decrease if machinery broke up these pieces. Negative effects would be partly mitigated by return skidding slash, although pieces would be substantially smaller post-harvest. Snags may be removed if considered to be unsafe to work around. Therefore, harvest would have short-term negative effects and long-term benefits to the large tree component by thinning from below. Harvest would have short and long term negative effects to large snags and pieces of coarse woody debris, if they are broken up or removed from the site or recruitment is interrupted. Negative effects would be somewhat mitigated by retaining Douglas fir or ponderosa pine snags, retaining large live trees to be potentially recruited to snags, and

returning skidding large pieces of slash.

Regarding old growth stands and components, Alternative A would have the fewest negative effects, because no road would be built and post and rail thinning would not occur. Alternative D would likely have the next fewest negative effects, because although more road miles would be built, less area would be entered with post and rail thinning, no old growth harvested and the ditch would not be repaired. Less thinning means less necessity for sawyers to fell snags or snag recruits for safety or logistic considerations. Alternatives B and C would be fairly similar regarding old growth resources.

Thinning would occur in Lodgepole pine stands that are not less than 90 years old. In general, because only small trees would be removed, post-and rail thinning would have no negative direct and cumulative effects to old growth stands and components in the project and analysis areas.

Cumulative Impacts

Alternatives A & D

Unharvested areas within the analysis area do contain old growth habitats and components. Given the large amounts of unharvested and unroaded area in the analysis area, there would be small cumulative negative effects to old growth stands and components by any proposed action alternative. Alternative D, like A, does not propose to harvest any old growth.

Under both of these alternatives, stands which meet the Green et al. definition of old growth would be eliminated from any harvesting or road construction. In Chapter 3, Table 3-8, we talked about the current age class distribution and how it is skewed toward older stands when compared to the data from Losensky (1993). Losensky's data indicates that approximately 4% of the lodgepole pine stands within this climatic zone should be classified as old stands, >141 years old. Approximately 10% should be 101-140. Currently within the Anaconda Unit there are 13.4% old stands and 32.5% in the 101-old stand age category. We are substantially lacking the younger age class category, age 1-40, which should comprise 34% of the State's lodgepole pine stands comprises only 9.8%.

Alternative D would allow harvesting in the 41-100 and 101 old stand age categories, which would move a portion of the older stands into the 1-40 age group. This movement would improve stand stability while reducing their susceptibility to insect and disease attack. Alternative A would not authorize any harvesting; consequently there would not be a change in age class distribution. Both Alternatives A and D would retain all stands meeting the Green et al (1992) definition of old growth. This would continue the high susceptibility of these stands to insect and disease attack, reduce stand stability and increase their susceptibility to stand replacing fires. Acreage of old growth would be maximized while younger age classes, 1-40, would be minimized.

Alternatives B & C

While the previously described alternatives would maintain short-term old growth presence, B and C would decrease 101 years old stand and old stand age groups. The age class distribution would be moved toward conditions, which more closely resemble those historically present. Size of stands older than 101 years would be reduced while those in the unstocked and 1 to 40 age group would increase. Stability of the stands would be improved by the harvesting either by increasing between tree spacing or converting an older stand to one, which is, regenerating and not susceptible to bark beetles. These stands would also be less susceptible to stand replacing fires because of a reduction in tree density and ground fuel accumulation. Specific to the Upper Willow Creek drainage, there would be a decrease in those stands meeting the Greene old growth definition on State land. There would continue to be substantial old growth lodgepole pine stands on adjacent USFS lands (per observation F. Staedler), thus minimizing impacts within the drainage.

The age class distribution within the project area and through out trust land on the Anaconda Unit is substantially different then research indicates is the historical norm (Losensky, 1993). Without harvesting wildfire, insect attacks or the passage of time current age class distribution would remain in its present state. In the short term there would be little impact. Over the long term this disproportionate weighting toward old stands is not a stable condition. Build-up of fuels in the stands will lead to the occurrence of large high intensity stand replacing fires. While this type of fire has historically played a major role in the ecology of these systems, it is reasonable to assume that the addition of 90 years of fuel accumulation caused by suppression of wildfires has moved it outside of the “normal” parameters.

The proposed harvesting has been designed to simulate the effects that fire and insects would have creating a view shed, which would somewhat emulate presettlement conditions. Stands which have a high fuel loading potential have been proposed for removal of all trees to simulate the occurrence of a stand replacement fire. Where fuels are lighter and Douglas fir or ponderosa pine are present, large, scattered trees would be left. This type of harvesting would simulate the occurrence of a mixed severity fire. Forest processes operate in a cyclical manner. Natural processes of establishment, growth, maturation, decadence, and death are always occurring.

Table 4-14
Age Class Distribution for Lodgepole Pine Stands Within Anaconda Unit

Age Class	Historic Levels (Losensky 1973)	Anaconda Unit Current Age Class Distribution		All State Land In Upper Willow Creek	
	Ac.	Ac.	%	Ac.	%
Non-Stocked	9%	0	0	0	0
1-40	34%	515.5	9.8	126.6	6.2
41-100	43%	2316.7	44.3	1542.5	75.1
101-Old Stand	10%	1701.3	32.5	201.5	8.7
Old Stand	4%	699.9	13.4	189.6	9.2
Total		5233.4		2060.2	

Age Class Distribution for Lodgepole Pine Stands Within Anaconda Unit



Table 4-15
Impacts of Alternatives to Age Class Distribution Within the Sale Area

Age Class	Alternative A Existing Condition		Alternative B & C		Alternative D	
	Ac.	%	Ac.	%	Ac.	%
Non-Stocked	0	0	285	16.8	162	9.6
1-40	0	0	0	0	0	0
41-100	1300.7	76.9	1200.7	71	1200.7	71
101-Old Stand	201.5	11	139.5	8.2	139.5	8.2
Old Stand	189.6	12.1	66.6	4.0	189.6	11.2
Total	1691.8		1691.8		1691.8	

Impacts of Alternatives to Age Class Distribution Within the Sale Area



Effects of Noxious Weed Management

Under the no-action alternative, noxious weeds may establish on 4 WD roads and onto dry vegetation sites by unauthorized vehicles or animal use.

Effects of Alternatives

The Montana County Noxious Weed Act (MCA 7-22-2102-2153) requires State agencies to submit plans to manage noxious weeds where they occur, through planning and implementation of integrated management measures of prevention, revegetation and control. The action alternatives will involve ground-disturbing activities and traffic that have the potential to introduce or spread noxious weeds in susceptible habitat types. For the action alternatives, an Integrated Weed Management (IWM) approach was considered by DNRC and a combination of prevention and revegetation measures are considered the most effective weed management treatments for all proposed action alternatives. To reduce the possible introduction and spread of weeds associated with this project, the following prevention measures would be implemented for new road construction and areas of disturbance along the existing access road.

- All road construction and harvest equipment would be cleaned of plant parts, mud and weed seed to prevent the introduction of noxious weeds. Equipment will be subject to inspection by forest officer prior to moving on site.
- All newly disturbed soils on road cuts and wills would be promptly reseeded to site adapted grasses to reduce weed encroachment and stabilize roads from erosion. Within the course of the project areas that have not revegetated would be reseeded.
- DNRC will monitor the project area for noxious weeds for two years after harvest operations. If noxious weeds are noted DNRC will develop a weed management plan.

Economics

The cash flow analysis estimates the project revenues and costs from the different treatments. This analysis estimates the cash flow from timber harvesting and non-administrative sale costs for alternatives considered. DNRC does not have a formal accounting system to track costs for

individual projects. An annual cash-flow analysis is conducted of DNRC's forest-product sales program. The results from previous years can be found in Chapter 3. The following assumptions were used in this analysis.

1. Estimates of return are approximate numbers intended for relative comparison of alternatives. They are not intended to be used as absolute estimates of return.
2. Harvested volume was based on estimates from cruise plots. The estimated volume may change with final cruise information, but relative difference between action alternatives should be the same.
3. Development costs on this proposal are the estimated cost of road and watershed improvement items that would be paid for by the purchaser. These improvements provide access to Trust Lands and improve water quality. The purchaser would pay for these costs. Average cost per mile of new construction was assumed to be \$10,000, reconstruction \$4,000, temporary road \$1,000. Alternatives B, C and D would involve the purchase of a \$30,000 permanent easement from the USFS.
4. Forest Improvement (FI) collection is based on the program wide costs to maintain ongoing staffing, stand treatments and road maintenance, and right-of-way acquisition. Money collected under FI from a purchaser provides funding for the State to accomplish projects such as tree planting, site preparation, burning, slash treatment, thinning, road maintenance, road acquisition, and for some timber sale related activities. Thus, the State is able to improve long-term productivity of timber stands and maintain or acquire access for future revenue-producing projects.

TABLE 4-16
SALE SPECIFIC FOREST IMPROVEMENT ACRES TREATED BY METHOD
AND ALTERNATIVE

Alternative	Treatment Method		
	Broadcast Burning (Acres)	Dozer Piling (Acres)	Pile Burning (Acres)
A	0	0	0
B	213	84	751
C	213	84	1095
D	120	53	677

TABLE 4-17
SALE SPECIFIC FOREST IMPROVEMENT COST BY ALTERNATIVE,
METHOD AND TOTAL

Alternative	Cost by Treatment Method and Total			
	Broadcast Burning	Dozer Piling	Pile Burning	Alternative Total
A	0	0	0	0
B	\$19,170	\$5,880	\$3,755	\$28,805
C	\$19,170	\$5,880	\$5,475	\$30,525
D	\$10,800	\$3,710	\$3,385	\$17,895

5. Total net income to the Trust is the net sawlog income plus post and rail net income.
6. In addition to the sawlog products proposed for harvest from this project area, commercial thinning would result in harvesting of post and rail material. The estimated value is \$150 per acre. Alternative A has zero acres while alternatives B,C, and D propose 667 acres, 1011 acres 624 acres respectively.
7. DNRC does not have any revenue generating activities that are solely dependent on this project area. There are no outfitters and guides who license the acres in this project area.
8. Limitations of the economic analysis 1) Only known cost and benefits that are related to timber harvesting activities or other revenue producing activities are considered; (2) None of the potential benefits associated with leaving trees (i.e. snag recruitment, structural diversity, aesthetics, wildlife habitat, nutrient recycling, etc.) are considered.

Table 4-18
Costs and Benefits Associated with the Proposed Project by Alternative

Alternatives	A	B	C	D
1. Estimated sawlog volume in MBF *	0	3,000	3,000	1,500
2. Delivered price/MBF **	0	\$350	\$350	\$350
3. Total gross sawlog income in \$	0	\$1,050,000	\$1,050,000	\$525,000
4. Development costs including roads and easement costs \$/MBF	0	\$29.57	\$29.57	\$54.73
5. F.I. Charges \$/MBF	0	\$47.70	\$47.70	\$47.70
6. Logging, skidding & hauling costs \$/MBF	0	\$173	\$173	\$173
7. Total Costs \$/MBF	0	\$250	\$250	\$275
8. Total Sawlog Costs \$	0	750,000	750,000	412,500
9. Net sawlog income in \$ (Line 3-8)	0	300,000	300,000	112,500
10. Net sawlog income \$/MBF (9 divided by 1)	0	\$100	\$100	\$75
11. Post & rail harvesting acres	0	668	1036	624
12. Estimated stumpage \$/acre ***	0	150	150	150
13. Total post & rail income \$	0	95,700	155,400	93,600
14. Total net income to the trust \$ (Line 9 + 13)	0	395,700	455,400	206,100

* To reduce complexity a specific volume was selected within the range identified throughout this document.

** Delivered price was determined by contacting two local sawmills.

*** This value was estimated by the project leader from past experience in selling this type of material under similar circumstances.

Direct, Indirect, and Cumulative Effects of No-Action Alternative A to Economics

None of the employment, income, or trust fund effects that result from the action alternatives would occur with No-Action Alternative A.

Direct Effects of Action Alternatives B, C and D to Economics

Timber sale Effects

The estimated revenue and expenditures associated with the Phoenix Timber Sale are shown in Table 4-8. Because no timber-harvesting impacts are associated with No-Action Alternative A, the remaining analysis will focus on the other 3 alternatives. The 3 alternatives analyzed may ultimately be broken into smaller sales, but are treated as a unit for the purpose of this analysis. The volume associated with Action Alternative B and C is 3.0 MMBF. The corresponding volume for Action Alternative D is 1.5 MMBF.

Stumpage prices have improved in recent months but remain below the long-term average, are highly dependent on the housing market and the import market, which dependent primarily on mortgage rates and currency exchange rates, respectively. The interest rate, in part, determines who can “qualify” to purchase a home. Interest rates are currently at very low levels, which have not been seen since the late 1950s and early 1960s. These low interest rates impact the housing market by stimulating new construction to satisfy the demand for housing from individuals who can now “qualify” to purchase a home. The economy is in a period of increasing growth and appears to be moving out of the recession. As a result, housing starts appear to be remaining strong. A weaker dollar relative to most other currencies has stimulated exports and made foreign lumber more costly in US markets. These changes have resulted in recent increases in the prices paid for wood at all market levels in recent months. The timber prices used in this analysis attempt to recognize the current market conditions (see Table 4-19) by showing the difference in revenue to the trusts from the 3 action alternatives.

The estimated school trust income from Action Alternative B is \$395,700, enough to fund the education of 65 students for 1 year, based on an average cost of \$6,038, as determined from information provided by the Montana Office of Public Instruction (see Table 4-19). If the sale does not take place no students are benefited. Thus, one of the “costs” of not harvesting the timber, compared to harvesting under Action Alternative B, is the loss of financing for 65 kindergarten through grade 12 students for 1 year. If the trust does not fund these students through the sale of timber, funding might come from other sources, primarily property taxes.

The School Trust income from Action Alternative C is estimated to be \$455,400, enough to fund the education of 75 students for 1 year, based on an average cost of \$6,038, as determined by information provided by the Montana Office of Public Instruction (see Table 4-19). If the sale does not take place, no students are benefits. A “cost” of not harvesting compared to harvesting the timber under Action Alternative C is the loss of financing for 75 kindergarten through grade 12 students for 1 year.

Action Alternative D would generate approximately \$206, 100 in School Trust income. This

would provide enough money to educate 34 students for one year, based on an average cost of \$6,038 per year, as determined by information provided by the Montana Office of Public Instruction (see Table 4-19). If the sale does not take place, no students are benefited.

Table 4-19
Number of Students supported by one year's Estimated Revenue

	ACTION ALTERNATIVE B	ACTION ALTERNATIVE C	ACTION ALTERNATIVE D
Estimated school revenue	\$395,700	\$455,400	\$206,100
Students supported	65	75	34
<p>The purpose of this table is to give a comparative analysis of the alternatives, not an absolute measure of the number of students that will be supported by the estimated trust income and a nonmonetary indication of the fund benefits. DNRC does not recognize that 95 percent of these funds must be appropriated by the legislature and 5 percent will be allocated to the school trust fund where the earnings are used to provide education funding for students in the future.</p> <p>Source: Montana Department of Revenue, Trust Land Management</p>			

Without a timber harvest, income would be lost to the State and communities. As indicated earlier, wages in the timber industry are higher than average. This allows individuals working in the industry to obtain higher than average ownership of real personal property. Since much of the revenue for school funding comes from property taxation, higher levels of real property ownership should provide for better school funding.

In addition to these jobs, additional employment is created when the income earned within the timber industry is spent to purchase goods and services elsewhere in the economy. Both of these effects are important since they support other community businesses, such as grocery stores, clothing stores, and gas stations. The loss of the income from this sale would mean not only the loss of the direct income, but the loss of the indirect income as well.

The economic impact on the schools occurs through ways other than just the direct contribution to the school trust fund from the revenue generated through timber sales. The wood industry pays taxes on the facilities it owns and operates.

Other Indirect Effects

Indirect economic impacts are much broader than those identified in the previous section. Some of these impacts are the result of the money from the sales "recycling" through the economy several times. For example, the money spent for groceries by the employee of the timber mill, in part, goes to pay the salary of the grocery store employee, the grocery store employees' use that money to purchase groceries for themselves. This, in turn, generates more income for the grocery store employees, etc. Unfortunately, a model of the county that could be used to

demonstrate secondary effects is not available. In a broader State-wide contest, money paid to wood-industry workers results in increased State income-tax collections, as well as increased purchases in other areas of the State. Since the State revenue is spent on projects State-wide, the entire State shares, in part, in the benefits that result from the timber sale. In particular, Montana schools benefit additionally by being able to use these revenues to fund schools throughout the State.

Impacts on Local Communities

Estimates were made of the impact on local communities by using community multipliers information.

The impacts on local communities are estimated by quantifying jobs and income that are associated with harvesting and processing timber into final products. Regional response coefficients for the Southwest part of Montana indicate that direct jobs per MMBF harvested is 9.6 per MMBF and total income per MMBF of harvested volume is \$325,118 or an average income of \$33,866.46 per job (Keegan and Wichman, 1996).

Cumulative Economic Effects of All Alternatives

The last survey of Montana's forest products industry was completed in 1994 (Keegan et al. 1995). Long-term impacts of timber supply are difficult to assess given today's global markets. The importance of State Timber Sales to regional economy is dependent upon the wood supply originating on U.S. Forest Service, private non-industrial, private industrial, and tribal lands. This proposed sale represents approximately 2% of sawtimber processing for the following counties Granite, Ravalli, Powell, Deer Lodge, Silver Bow, Beaverhead Madison, Gallatin and Park. These estimates are from Montana's Forest Products Industry "a Descriptive Analysis" 1969–1994 (Keegan et al. 1995). Bureau of Business and Economic Research, University of Montana, Missoula, Montana and were adjusted for the loss of a mill in Ravalli county.

Irreversible and Irretrievable Commitments of Natural Resources

Irreversible commitments result from decisions to use or modify resources, which cannot be reversed except over a long period of time (Montana DNRC, 1996). Forests are a renewable resource and consequently timber harvesting does not represent an irreversible commitment of resources. The proposed timber harvesting was designed to emulate historic occurrences and conditions with even and uneven-aged stands as a result. Under these proposed harvests, some old trees would be removed, but most would be retained within the project area to continue to contribute to structure in the residual stands. Although construction of roads is not considered irreversible, the planned road system would be maintained to provide long-term access to all of these parcels. There are no expected irreversible results from the proposed actions.

Irretrievable commitments refer to resource production or use of a renewable resource, which is lost for a shorter period of time usually due to land allocation or scheduling decisions (Montana DNRC, 1996). Under the preferred Alternative, C, growth and revenue that is lost due to lack of

management along Bear, Beaver Creek and the unnamed tributary in Section 17 is not retrievable. Otherwise, there are no expected irretrievable results from the proposed actions.

All harvest alternatives are designed to protect long-term productivity of the sites. It is anticipated that stocking reductions occurring under each alternative would increase the health and growth of residual stands, resulting in an increase in long-term productivity. Post harvest stands would more closely resemble stands, which existed under historic conditions, and would provide a variety of opportunities for use in the long term.

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